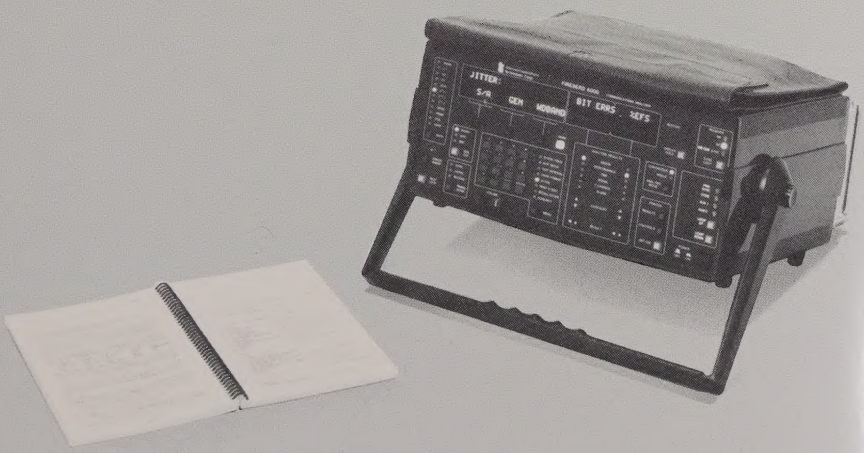
USER'S GUIDE

FIREBIRD 6000

Communications Analyzer



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FIREBIRD 6000

USER'S GUIDE

FEBRUARY, 1991

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SECTION 1
INTRODUCTION TO THE FIREBERD 6000

1.1 SECTION SUMMARY

This section provides an overview of the *FIREBERD 6000 User's Guide* and highlights the product it serves to describe.

1.2 ABOUT THIS DOCUMENT

The *FIREBERD 6000 User's Guide* is designed for all users of the FIREBERD 6000 Communications Analyzer. It is specifically dedicated to making the FIREBERD 6000 as easy to use as possible. With that in mind, you'll learn about the key elements of digital testing with the FIREBERD 6000, and how the instrument is set up in a variety of common test scenarios.

This document doesn't describe everything about the FIREBERD 6000; the instrument is fully addressed in the *FIREBERD 6000 Operating Manual*. But those requiring easy access to basic information and step-by-step test set-up procedures will find the *FIREBERD 6000 User's Guide* a handy tool.

1.2.1 Using This Manual

The *FIREBERD 6000 User's Guide* can be used in two ways:

- As a cover-to-cover user's manual.
- As a reference to specific information.

If you are using the FIREBERD 6000 for the first time, you are encouraged to read the manual from cover-to-cover. If you are familiar with how the instrument works, the indexes in this chapter will help you find specific information quickly.

NOTE: The material in this manual is based on REV. G software; however, the manual is also designed to be helpful to users with earlier software releases.

1.3 INTRODUCING THE FIREBERD 6000

The FIREBERD 6000 Communications Analyzer is an instrument that is used to test the quality of digital communications networks and equipment. It is used in locations such as the central office, technical control center, end-user site, engineering laboratory, and earth station.

1.3.1 Using the FIREBERD 6000

The FIREBERD 6000 can be used in many different test applications. Almost all such applications involve six key elements:

1. Selecting a test data pattern.
2. Selecting a signal timing source.
3. Selecting a timing mode.
4. Configuring the FIREBERD 6000 menus for the test you wish to run.
5. Running the test.
6. Collecting the results.

TO:	GO TO:
Learn about data pattern selection.	2-1
Learn about signal timing selection.	2-4
Learn about timing mode selection.	2-4
Learn about configuring FIREBERD 6000 menus.	2-5
Learn about running the test.	2-9
Learn about collecting test results.	2-10

NOTE: Section 1.7 offers an index to any specific test set-up available in this manual.

1.4 WHAT THE FIREBERD 6000 DOES

Here is a table that shows the kinds of tests you can perform with the FIREBERD 6000 and some typical applications within each category.

THE FIREBERD 6000 PERFORMS	ON THE FOLLOWING DIGITAL EQUIPMENT
Asynchronous Testing	Asynchronous terminals, printers, modems, computers, and any asynchronous link up to speeds of 20 kb/s.
Synchronous Testing	Synchronous modems and data channels, all basic data applications, channel cards, etc.
DDS Testing	Subrate multiplexers, Office Channel Units (OCUs), Channel Service Units (CSUs), Data Service Units (DSUs), cables, etc.
T1/G.703 Testing	T1 and G.703 links, multiplexers, cross-connect systems, channel service units (CSUs), channel banks, and repeaters.

1.5 DIGITAL INTERFACES: THE KEY TO FLEXIBILITY

The key to the FIREBERD 6000's flexibility is its broad selection of digital interfaces. Using these interfaces, the FIREBERD 6000 can test digital equipment operating at data rates from 50 b/s to 15 Mb/s. In addition to a built-in RS-232 interface, the instrument features modular interfaces that are installed in a slot located at the instrument's rear panel.

This manual describes FIREBERD 6000 operation with these interfaces:

- RS-232-C/V.24 (Built-in)
- DS1/T1/D4/ESF (Model 40460)
- DS1/T1/D4/ESF/SLC-96 (Model 40540)
- T1/FT1 (Model 41440)
- V.35 (Model 40202)
- RS-449/V.10,V.11 (Model 40200)
- RS-449/530/MIL (Model 41400)
- DDS DS0A/B (Model 30678)
- DDS Local Loop (Model 41131)
- CCITT G.703 64 kb/s (Model 30608)

- CCITT G.704 2048 kb/s (Model 30609)
- ISDN S/T TE (Model 41075)

1.6 TEST RESULTS

Based on the kind of interface selected and the kind of test performed, the FIREBERD 6000 can perform as many as 50 test measurements simultaneously. In addition to error, timing, and signal (including advanced jitter generation and measurement) analysis, the instrument performs bipolar violation, framing error, and CRC error analysis.

1.7 INDEX TO SET-UP PROCEDURES

Section 2 of this manual covers the six key elements of setting up and analyzing a FIREBERD 6000 test. New users of the FIREBERD 6000 are encouraged to read this chapter as a means of learning about the instrument's switches, menu functions, etc. and how they relate to these six key test elements.

Users who are already familiar with the functionality of the FIREBERD 6000 or who want immediate access to test set-up procedures should consult Sections 1.7.1 through 1.7.11.

1.7.1 RS-232 (V.24) Data Interface Index

TO:	GO TO:
View the interface's basic attributes.	2-14
View a local loopback synchronous test.	3-1
View a remote loopback synchronous test.	3-3
View an end-to-end synchronous test.	3-5
Set up an RS-232 synchronous test.	3-5
View the available test results for RS-232 synchronous testing.	3-16
View a local loopback asynchronous test.	3-17

1.7.1 RS-232 (V.24) Data Interface Index (continued)

TO:	GO TO:
Set up an RS-232 asynchronous test.	3-19
View the available test results for RS-232 asynchronous testing.	3-21

1.7.2 V.35 Functional Index

TO:	GO TO:
View the interface's basic attributes.	2-17
View a remote loopback synchronous test.	3-13
View a V.35 synchronous test.	3-13
View the available test results for a V.35 synchronous test.	3-16
View the available test results for a V.35 asynchronous test.	3-21

1.7.3 RS-449 Functional Index (V.10/V.11)

TO:	GO TO:
View the interface's basic attributes.	2-19
View a local loopback synchronous test.	3-9
Set up an RS-449 synchronous test.	3-11
View the available test results for an RS-449 synchronous test.	3-16
View the available test results for an RS-449 asynchronous test.	3-21

1.7.4 DDS DS0A/B Functional Index

TO:	GO TO:
View the interface's basic attributes.	2-22
View an OCU latching loopback test.	3-22
Set up a basic OCU latching loopback test.	3-24
View a multipoint DSU loopback test.	3-25
Set up a basic multipoint DSU loopback test.	3-27
View a secondary channel straightaway test.	3-29
Set up a basic secondary channel straightaway test.	3-29
View the available test results for DDS testing.	3-32

1.7.5 DS1/T1 Functional Index

TO:	GO TO:
View the DS1/T1/D4/ESF Interface's basic attributes.	2-16
View the DS1/T1/D4/ESF/SLC-96 Interface's basic attributes.	2-18
View a remote loopback test.	3-33
Set up a T1 loopback test.	3-35
View an end-to-end T1 test.	3-37
View available T1 test results.	3-39
View a scenario for in-service monitoring.	3-41
View test results for in-service monitoring.	3-41
Learn about measuring network jitter.	3-45
Set up a test for network jitter measurement.	3-47
View network jitter measurement test results.	3-49

1.7.6 G.703 64 kb/s Functional Index

TO:	GO TO:
View the interface's basic attributes.	2-23
View an end-to-end G.703 test.	3-51
Set up a G.703 64 kb/s test.	3-51
View available G.703 test results.	3-54
Learn about measuring network jitter.	3-58
Set up a test for network jitter measurement.	3-60

1.7.7 G.704 2048 kb/s Functional Index

TO:	GO TO:
View the interface's basic attributes.	2-23
View an end-to-end test.	3-55
Set up a G.704 2048 kb/s test.	3-55
View available G.704 2048 kb/s test results.	3-58
Learn about measuring network jitter.	3-58
Set up a test for network jitter measurement.	3-62

1.7.8 ISDN S/T Functional Index

TO:	GO TO:
View the interface's basic attributes.	2-28
View a test where voice and data are measured simultaneously.	3-65
Set up a voice call.	3-67
Set up a data call.	3-69
View available ISDN test results.	3-72

1.7.9 T1/FT1 Functional Index

TO:	GO TO:
View the interface's basic attributes.	2-30
View an end-to-end test of a fractional T1 circuit.	3-75
Set up an end-to-end test of a fractional T1 circuit.	3-76
View a test for installing and troubleshooting customer premise equipment.	3-77
Set up a test for installing and troubleshooting customer premise equipment.	3-78
View the results that are available with the DS1/FT1 Interface.	3-79

1.7.10 RS-449/530/MIL Functional Index

TO:	GO TO:
View the interface's basic attributes.	2-32
View a synchronous test for a modem that uses the EIA-530 connector.	3-80
Set up a synchronous test for modems and multiplexers that use the EIA-530 connector.	3-81
View the results that are available with the RS-449/530/ MIL Interface.	3-83

1.7.11 DDS Local Loop Functional Index

TO:	GO TO:
View the interface's basic attributes.	2-37
View a network loopback test.	3-87
View a channel loopback test.	3-90
Set up a test with the DDS Local Loop Interface	3-88

1.7.11 DDS Local Loop Functional Index

TO:	GO TO:
View the results that are available with the DDS Local Loop Interface.	3-93

SECTION 2
SETTING UP THE FIREBERD 6000

2.1 SECTION SUMMARY

This section describes the key elements of setting up a test with the FIREBERD 6000. These elements are controlled from either the FIREBERD 6000's front panel or the installed data interface.

The selection of data patterns, signal and timing characteristics, test configuration, and analysis modes is controlled by the FIREBERD 6000's switches, menu functions, keypads, and displays. The key elements of any FIREBERD 6000 test vary with the specific interface installed.

2.2 KEY ELEMENTS OF FIREBERD 6000 TESTING

The following steps are usually performed when setting up a FIREBERD 6000 test:

1. Select a test data pattern.
2. Select a signal timing source.
3. Select a timing mode.
4. Configure the FIREBERD 6000 menus for the test you wish to run.
5. Run the test.
6. Collect the results.

1. Selecting a Data Pattern

The **DATA** switch selects the pattern or message to be used when conducting a test. Data pattern selection is controlled by an electronic slide switch. The current data pattern is marked by the illumination of the indicator next to the data pattern label. When the pushbutton portion of the switch is pressed momentarily or held down, the indicator changes to reflect the newly selected data pattern.

The tables on the pages immediately following describe the test data patterns available using the DATA switch and when each is best used.

Table 2-1
DATA Switch Patterns

PATTERN	DESCRIPTION:	PROVIDES:
MARK	All ones, fixed, "keep-alive" pattern. Equivalent to Red Alarm signal.	Maximum power level for T1 signal. Stresses T1 repeater's minimum power require ments. Also useful for signal tracing or as an idle pattern.
1:1	Fixed pattern of single alternating Marks and Spaces.	Minimum stress on clock recovery circuits.
63	2^6-1 pseudorandom pattern with a maximum of 5 sequential zeroes and 6 sequential ones.	Lowest stress of any pseudorandom pattern. Recommended for synchronous and asynchronous testing.
511	2^9-1 pseudorandom pattern with a maximum of 8 sequential zeroes and 9 sequential ones.	Compatibility with DDS equipment. Recommended when testing below the rate of 9.6 kb/s.
2047	2^{11}-1 pseudorandom pattern with a maximum of 10 sequential zeroes and 11 sequential ones.	Compatibility with DDS equipment. Suited for testing at data rates be tween 9.6 and 56 kb/s.
2^{15}-1	Pseudorandom pattern with a maximum of 14 sequential zeroes and 15 sequential ones.	Compatibility with O.151 specification for 64, 1544, 2048, 3152, and 6312 kb/s data rates. Provides maximum number of sequential zeroes allowable in framed, non-B8ZS testing. Recommended for testing at data rates above 19.2 kb/s. Standard for G.703 testing.
2^{20}-1	Pseudorandom pattern with a maximum of 19 sequential zeroes and 20 sequential ones.	Higher stress than the 2^{15}-1 pattern. Recommended for T1 applications where excess zero transmission is required.

Table 2-1
DATA Switch Patterns (continued)

PATTERN	DESCRIPTION:	PROVIDES:
2^{20}-1 (cont.)		Cannot be used in asynchronous timing mode.
2^{23}-1	Pseudorandom pattern with a maximum of 22 sequential zeroes and 23 sequential ones.	Highest stress of all pseudorandom patterns. Cannot be used in asynchronous timing mode.
QRSS	2^{20}-1 pattern modified to transmit a maximum of 14 consecutive zeroes.	Simulation of live data. QRSS is the standard data pattern for T1 testing. Cannot be used in asynchronous timing mode.
PRGM	A user-programmable bit pattern, configured using Auxiliary Function 33.	The ability to generate a 3-to-24 bit user-programmable pattern.
FOX	A message that includes the numbers 0-9 and all uppercase letters (THE QUICK BROWN FOX JUMPS OVER THE LAZY DOG 0123456789). When both the Long User Pattern and synchronous timing are used, a 7-bit QUICK BROWN FOX ASCII message is transmitted. In asynchronous mode, the FOX message is transmitted according to the number of data bits specified in the character format: 5 bits: Baudot 6 bits: BCDIC 7 bits: ASCII 8 bits: EBCDIC	The standard asynchronous pattern for teletype communications. Also useful as the payload of synchronous protocols.
USER	Selects the pattern currently specified in Auxiliary Function 41.	The ability to use one of three Long User Patterns programmed in Auxiliary Function 41, or one of the additional "canned" patterns also offered in Auxiliary Function 41.

See Section 3 of the *FIREBERD 6000 Operating Manual* (under DATA switch) for a description of the patterns that are available in Auxiliary Function 41.

2. Selecting a Signal Timing Source

The **GEN CLK** switch selects the source of signal (transmit) timing when conducting a test. Like data pattern selection, signal timing selection is controlled by an electronic slide switch. The switch's current setting is marked by the illumination of the indicator next to the timing source. When the pushbutton switch is pressed momentarily or held down, the indicator reflects the newly selected timing source.

The table immediately following describes the sources of signal timing available with the FIREBERD 6000.

Table 2-2
Signal Timing

SELECT:	TO:
SYNTH	Choose the FIREBERD 6000's built-in frequency synthesizer as the source of signal timing. The synthesizer generates any frequency within the range of 50 Hz to 15 MHz.
INTF	Choose the clock originating from the network or the clock in the interface module as a source of signal timing.
BNC	Choose an external timing source. When selected, the external timing source must be connected to the GEN CLK IN BNC con nector on the FIREBERD 6000's rear panel.

3. Selecting a Timing Mode

The **TIMING MODE** switch selects the type of transmit and receive timing required at the testing interface. Like data pattern and generator timing selection, the selection of a timing mode is controlled by an electronic slide switch. LEDs indicate the currently selected timing mode.

The table immediately following describes the FIREBERD 6000's timing modes.

Table 2-3
Timing Modes

SELECT:	TO:
SYNC	Choose synchronous timing. In synchronous transmission, the time interval between data bits is fixed and based on a controlled clock rate. To provide the required timing information to the receiving equipment, the clock signal is transmitted with the data (on a separate lead).
ASYNC	Choose asynchronous timing. In asynchronous transmission, the data is divided into characters containing 5 to 8 bits each. Each character is "framed" with start and stop bits, and may also include a parity bit. No clock signal accompanies the data.
RECOVD	Choose recovered timing. In this mode, the receiver achieves bit synchronization from the transitions in the data stream. If present, the receive clock is ignored. **NOTE:** The Clock Recovery Option (Option 6004) is required to recover timing from synchronous signals to 520 kb/s.

4. Configuring the FIREBERD 6000 for the Test You Wish To Run

The FIREBERD 6000's menu facilities configure the instrument for any test you wish to run. The components of the menu facilities are as follows:

A. **MENU** switch
B. MENU display and softkeys
C. MENU keypad

A. The MENU Switch

The **MENU** switch is an electronic slide switch that is used to select a specific FIREBERD 6000 functional menu for display. These menus are provided for:

- Functions which have a large number of configurable parameters
- Functions that change with data interfaces or options
- Functions requiring numeric or hexadecimal entries

Each function associated with the **MENU** switch is briefly described in the table immediately following.

Table 2-4
Menu Functions

SELECT:	TO:
SYNTH	Choose a synthesizer frequency. Required when the FIREBERD's FREQ synthesizer is used as the source of signal timing (GEN CLK to SYNTH), and when the asynchronous or optional recovered timing modes are selected.
INTF	Choose the built-in RS-232 interface or the modular interface SETUP installed in the rear panel of the FIREBERD 6000. Required for all testing.
TEST	Choose a test interval. The test interval can be a fixed period of INTERVAL time or a fixed bit length. Required for all testing.
CHAR	Set the asynchronous character format (i.e., start, data, parity, FORMAT and stop bits). Required for asynchronous testing.
JITTER	Configure jitter analysis and generation options. The FIREBERD 6000's jitter capabilities are optional. When not installed, the message OPTION NOT INSTALLED appears on the MENU display.
PRINT	Set print event criteria. Test results can be sent to an external EVENT printer at the end of each test interval or upon the occurrence of specific events. Required for automatic hard-copy test results.
RECALL/ STORE	Store and recall up to 10 commonly used configurations.
AUXIL-IARY	Set up any of 29 additional configurable functions.

B. The MENU Display and Softkeys

The MENU display shows the current functional menu. When a function is selected, the top of the menu tree appears in the display, along with the function's current setting. The three MENU softkeys located below the display area control menu movement and selection.

To help guide you through a typical menu session, Figure 2-1 depicts a tree of the functions associated with the PRINT EVENT menu.

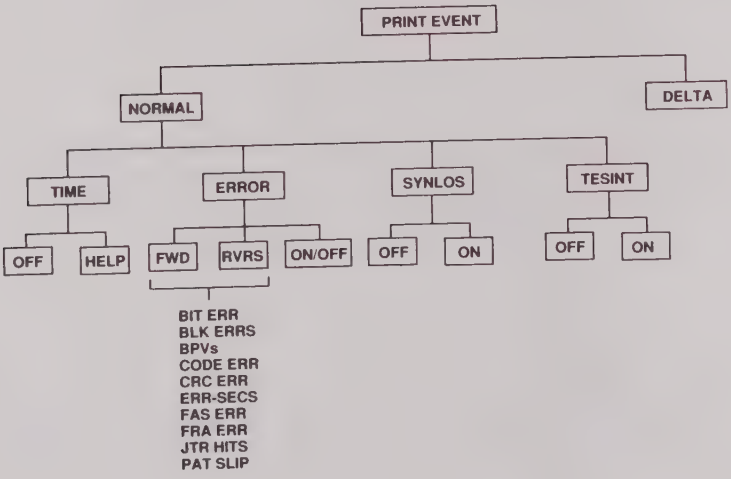
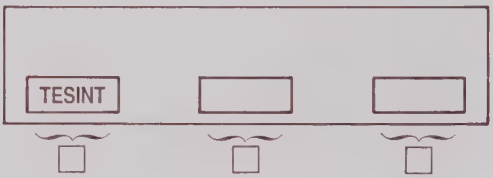


Figure 2-1
PRINT EVENT Menu Tree

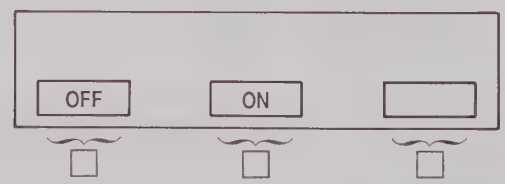
When the PRINT EVENT function is selected, the top of the PRINT EVENT menu tree appears in the MENU display. When a softkey is not used, the display area above the bracket is blank.

Pressing the softkey under NORMAL selects the functions associated with standard print events. The MENU display then shows the first three choices at the NORMAL menu's next level.

The **MORE** key (located to the right of the MENU softkeys) is illuminated when more than three softkey choices are available at the current menu level. When pressed, the next set of softkey labels are displayed.



When the softkey under any of these four menu choices is pressed (TIME, ERROR, SYNLOS, TESINT), the PRINT EVENT menu moves to its next level. For example, when the TESTINT softkey is pressed, the ON and OFF softkeys are displayed.



If you desire, you can initiate a printout at the end of each test interval by pressing the ON softkey. You can also return to the previous level in the menu at any time in the configuration activity by pressing the Up-Arrow (▲) key located on the MENU keypad.

C. The MENU Keypad

The MENU keypad is used with functions that have a range of values that are too large to be represented by a softkey. The keypad is also used to move backward through any menu tree and (where applicable) for cursor manipulation. The table immediately following describes the components of the MENU keypad.

Key	Function
0-9	Numeric entry.
Period (.)	Floating decimal point entry (e.g., synthesizer frequency).
SHIFT	Access to the hexadecimal digits A-F (labeled in blue). For example, to enter an A: 1. PRESS AND RELEASE the SHIFT key. 2. Press the blue-labeled A key.
ENTER	Terminate and implement keypad-entered data.
▲	Move to previous level in the menu.
▶ and ◀	Cursor manipulation for menus where all or part of a setting can be changed. ▶ Moves cursor to the right. ◀ Moves cursor to the left.

See the *FIREBERD 6000 Operating Manual* for more information on the MENU keypad.

5. Running the Test

Once you have configured and cabled the FIREBERD 6000 for the test you wish to run, the test automatically starts. The **ANALYSIS MODE** switch determines whether a test runs CONTINUOUSly or for a SINGLE iteration of the test interval.

When the **ANALYSIS MODE** switch is set to CONTINUOUS, test results are accumulated indefinitely. When the **ANALYSIS MODE** switch is set to SINGLE, results are accumulated for the length of the test interval only. Test length is controlled by the TEST INTERVAL function of the **MENU** switch.

SUGGESTION: Press the **RESTART** switch when you are ready to begin a test. This clears all results counters and starts a new test interval.

6. Collecting the Results

The FIREBERD 6000's ANALYSIS functions control test results. The switches and displays associated with these facilities are as follows:

- **CATEGORY** switches
- **RESULT** switches
- ANALYSIS RESULTS displays

The FIREBERD 6000 displays two sets of results simultaneously. The left and right **CATEGORY** switches are rocker switches that select a general analysis category for display. The left and right **RESULT** switches are used to scroll and select the specific analysis results available in each category. The left and right ANALYSIS displays show the actual test results. The left display reflects the left **CATEGORY** and **RESULT** switches; the right display serves the right **CATEGORY** and **RESULT** switches.

IMPORTANT: Both sides of the ANALYSIS function are identical (i.e, both sides work the same, and offer the same analysis categories and results).

Here is a table that shows the FIREBERD 6000's analysis categories and associated results. The test measurements that are significant vary with the kind of test being performed and the kind of data interface being used.

Table 2-5
Analysis Categories and Results

USE THIS CATEGORY SWITCH	TO COLLECT THESE RESULTS
ERROR	BIT ERRS (Bit Errors) AVG BER (Average Bit Error Rate) BER (Bit Error Rate) BLOCKS (Blocks) BLK ERRS (Block Errors) AVG BLER (Average Block Error Rate) CHAR ERR (Asynchronous Character Errors) PAT SLIP (Pattern Slips)

Table 2-5
Analysis Categories and Results (continued)

USE THIS CATEGORY SWITCH	TO COLLECT THESE RESULTS
PERFORMANCE	G.821 ERR SEC (Errored Seconds) G.821 EFS (Error-Free Seconds) G.821 %EFS (Percent Error-Free Seconds) DEG MIN (Degraded Minutes) %DEG MIN (Percent Degraded Minutes) SES (Severely Errored Seconds) %SES (Percent Severely Errored Seconds) G.821 VFS (Violation-Free Seconds) G.821 %VFS (Percent Violation-Free Seconds) UNA SEC (Unavailable Seconds) AVL SEC (Available Seconds) %AVL SEC (Percent Available Seconds) SVS (Severely Violated Seconds) %SVS (Percent Severely Violated Seconds) BER-SES (Bit Error Rate Minus Severely Errored Seconds) ERR-SES (Bit Errors Minus Severely Errored Seconds)
TIME	ERR EAS (Errored Error Analysis Seconds) E A SEC (Error Analysis Seconds) E F EAS (Error-Free Error Analysis Seconds) ELAP SEC (Elapsed Seconds) TIME (Time) DATE (Date) %ACT SEC (Percent Active Seconds) PATL SEC (Pattern Sync Loss Seconds) %PAT SEC (Percent Synchronized Seconds) SIGL SEC (Signal Loss Seconds)
SIGNAL	DELAY (Delay) MAX JTR (Maximum Jitter) 1SEC JTR (One-Second Jitter) JTR HITS (Jitter Hits) +WNDR (Positive Peak-to-Peak Wander) -WNDR (Negative Peak-to-Peak Wander) PP WNDR (Peak-to-Peak Wander) 15m WNDR (15-Minute Wander) 24h WNDR (24-Hour Wander)

Table 2-5
Analysis Categories and Results (continued)

USE THIS CATEGORY SWITCH	TO COLLECT THESE RESULTS
SIGNAL (cont.)	TIE WNDR (Tie Wander) RCV FREQ (Receiver Clock Frequency) GEN FREQ (Generator Clock Frequency) %MASK (Maximum Percent of Jitter Mask) S/A nnn (Spectrum Analyzer Frequency) RCV BYTE (Receive Byte) RCV CODE (Receive Code) PWR STAT (ISDN Power Feeding Status) R LVL-V (Receiver Signal Level in Volts) R LVL-dB (Receiver Signal Level in Decibels) TX INFO (Transmitter Information Sequence State) RX INFO (Receiver Information Sequence State) TEI (Terminal Equipment Identifier Assigned) +LVL V (Positive Level in Volts) +LVL dB (Positive Level in Decibels) -LVL V (Negative Level in Volts) -LVL dB (Negative Level in Decibels) PP LVL V (Peak-to-Peak Level in Volts) LVL dBm (Power Level of All-Ones Signal in dBm) DAT RATE (Data Rate) SMPX CUR (Simplex Current
T-CARRIER	BPVs (Bipolar Violations) BPV RATE (Bipolar Violation Rate) AVG BPVR (Average Bipolar Violation Rate) CODE ERR (Code Error Rate) CER (Code Error Rate) AVG CER (Average Code Error Rate) VF EAS (Violation-Free Error Analysis Seconds) %VF EAS (% Violation-Free Error Analysis Seconds) FRA ERR (Frame Errors) FE RATE (Frame Error Rate) AVG FER (Average Frame Error Rate) FRA LOSS (Frame Synchronization Loss) CRC ERR (CRC Errors) CRC E Rt (CRC Error Rate) AVG CRC (Average CRC Errors)

Table 2-5
Analysis Categories and Results (continued)

USE THIS CATEGORY SWITCH	TO COLLECT THESE RESULTS\
T-CARRIER (cont.)	FAS ERR (Frame Alignment Signal Error) FAS E Rt (Frame Alignment Signal Error Rate) AVG FAS (Average Frame Alignment Signal Error Rate) 1SEC CRC (One-Second CRC Errors) L2 F ERR (Layer 2 Frame Errors) FCS ERR (Frame Check Sequence Errors) L2 ABORT (Layer 2 Frame Abort) L2 FRMS (Number of Layer 2 Frames) REJ FRM (Rejection Frames) FRMR (Frame Rejection Frames) MAX ZERO (Maximum Consecutive Zeros) BIT SLIP (Bit Slips) RCV BOM (Received Bit-Oriented Message) RX ABCD (DS0 ABCD Signal)
ALARM	PAT LOSS (Pattern Synchronization Loss Count) DAT LOSS (Receiver Data Loss Count) CLK LOSS (Receiver Clock Loss Count) C-D CHA (Clock-Data Phase Change) PWR LOSS (Power Loss) SIG LOSS (Receiver Signal Loss) YEL SEC (Yellow Alarm Seconds) XS0 SEC (Excess Zero Seconds) AIS SEC (Alarm Indication Signal Seconds) 1S DEN S (Ones Density Violation Seconds) V FR SEC (Violated Frame Seconds) REM SEC (Remote Alarm Seconds)

2.3 USING INTERFACES

The key to the FIREBERD 6000's ability to test a wide range of digital equipment is its broad selection of interfaces. In addition to a built-in RS-232 interface, the instrument features modular interfaces that are installed in a slot located on the instrument's rear panel (see Figure 2-2). Using these interfaces, the FIREBERD 6000 can operate at data rates from 50 b/s to 15 Mb/s.

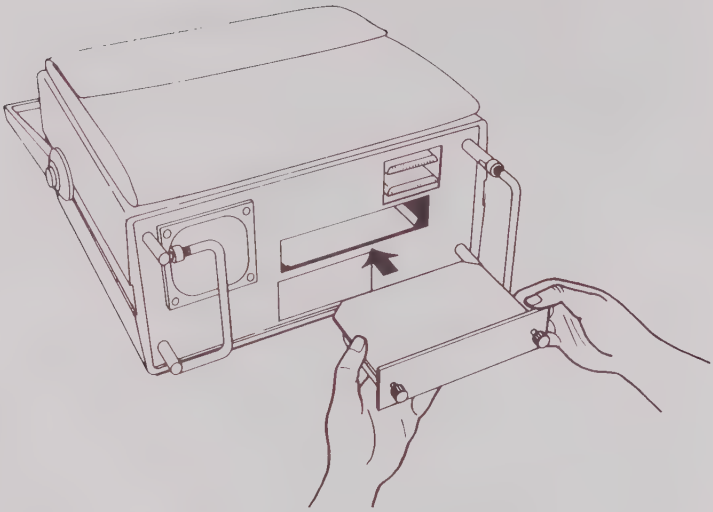


Figure 2-2
Installing a Modular Interface

Although the FIREBERD 6000 offers a broad array of interfaces, this manual only discusses the following interfaces:

- RS-232-C/V.24 (Built-in)
- DS1/T1/D4/ESF (Model 40460)
- DS1/T1/D4/ESF/SLC-96 (Model 40540)
- DS1/T1/FT1 (Model 41440)
- V.35 (Model 40202)
- RS-449/V.10,V.11 (Model 40200)
- RS-449/MIL (Model 41400)
- DDS DS0A/B (Model 30678)
- DDS Local Loop (Model 41131)
- CCITT G.703 64 kb/s (Model 30608)
- CCITT G.704 2048 kb/s (Model 30609)
- ISDN S/T TE (Model 41075)

Consult the *FIREBERD 6000 Operating Manual* for a list of all the interfaces available with the FIREBERD 6000.

2.3.1 RS-232-C/V.24 Data Interface (Built-In)

The RS-232-C/V.24 Data Interface is a built-in feature of the FIREBERD 6000. It meets EIA RS-232-C, CCITT V.24 and V.28, and ISO 2110-1980 standards.

PATTERNS	GEN CLK SOURCE	DATA RATES	TIMING MODES	FRONT PANEL CONTROL?	CABLES/ CONNECTORS
All	SYNTH, INTF, and BNC	ASYNC to 20 kb/s	Sync ASYNC and RECOVD	Yes	RS-232 6' male-to-male RS-232 10' male-to-male

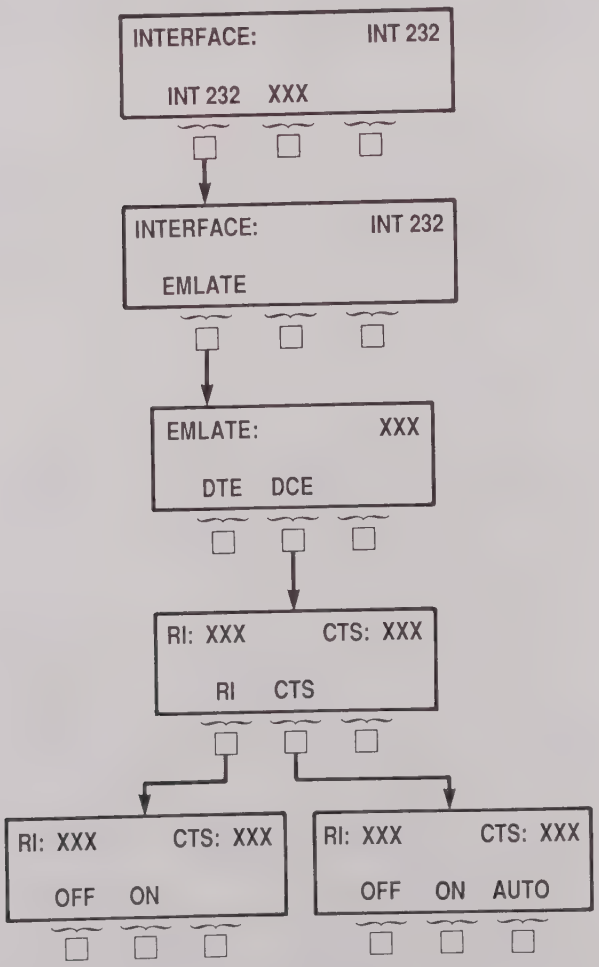
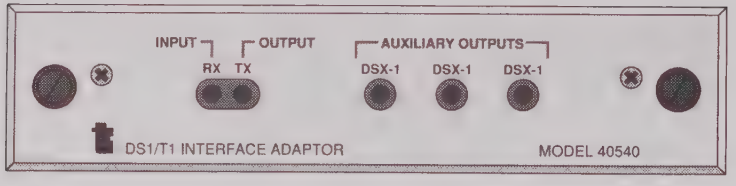


Figure 2-3
RS-232 Menu Tree

2.3.3 DS1/T1/D4/ESF/SLC-96 Interface



The DS1/T1/D4/ESF/SLC-96 Interface is identical in appearance to (and offers all of the functionality of) the DS1/T1/D4/ESF interface. Additional features include SLC-96 framing, logic or BPV error insertion, and two THRU-data modes: Line Loopback (LLB) and Test Loopback (TLB).

PATTERNS	GEN CLK SOURCE	DATA RATES	TIMING MODES	FRONT PANEL CONTROL?	CABLES/ CONNECTORS
All except FOX.	SYNTH, INTF, and BNC.	1.544 Mb/s	RECOVD only. (Switch disabled.)	Yes.	Bantam plug to alligator clips, bantam plug to bantam plug, and bantam plug to WECO 310.

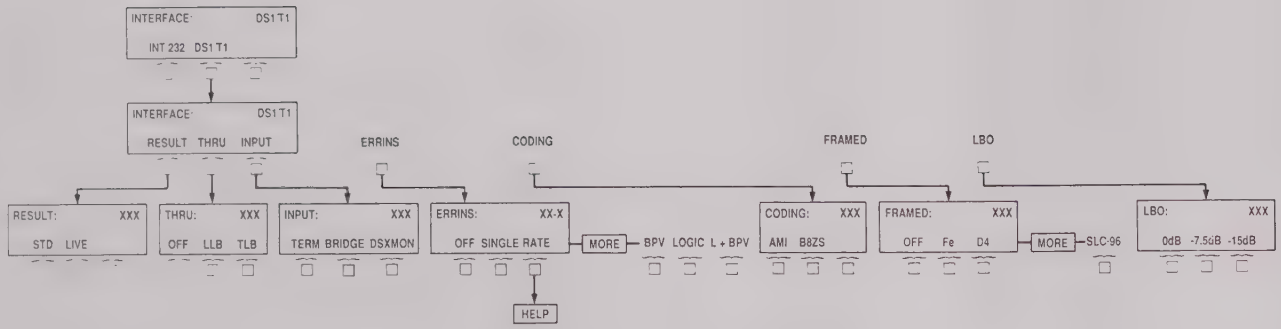
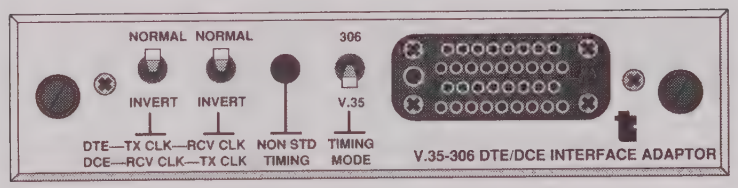


Figure 2-5
DS1/T1/D4/ESF/SLC-96 Menu Tree

2.3.4 V.35/306 Data Interface

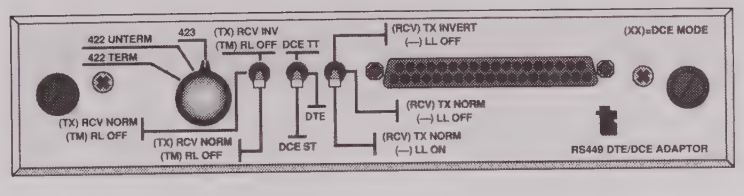


The V.35/306 Data Interface meets CCITT V.35 Recommendations and Bell System Technical Reference PUB 41304 (306-type wideband data set) specifications. The interface also meets PUB 41450 (DDS Data Service Unit) specifications.

PATTERNS	GEN CLK SOURCE	DATA RATES	TIMING MODES	FRONT PANEL CONTROL?	CABLES/ CONNECTORS
All.	SYNTH, BNC and INTF.	ASYNC to 20kb/s. SYNC: to 10Mb/s. RECOVD: to 520kb/s.	SYNC and ASYNC. (RECOVD available with Clock Recovery Option 6004.)	No. Interface only.	V.35 34-pin male-to-male connectors (6 and 10')

Since the V.35 Data Interface cannot be controlled at the front panel, no menu tree is shown.

2.3.5 RS-449 DTE/DCE Interface

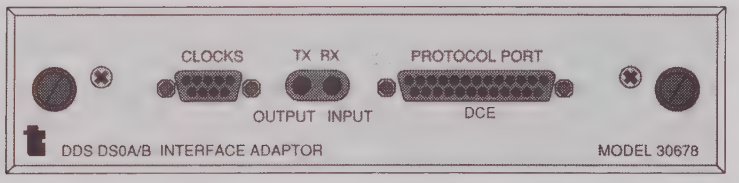


The RS-449 Data Interface meets RS-449 standards and CCITT V.10/V.11 Recommendations. The interface offers three modes of operation: RS-423 (unbalanced), RS-422 (balanced) terminated, and RS-422 (balanced) unterminated.

PATTERNS	GEN CLK SOURCE	DATA RATES	TIMING MODES	FRONT PANEL CONTROL?	CABLES/ CONNECTORS
All.	SYNTH, INTF and BNC.	ASYNC to 20kb/s. SYNC: 130kb/s for RS-423/V.10 drivers/ receivers to 520kb/s for RS-422/V.11.	SYNC and ASYNC. (RECOVD available with Clock Recovery Option 6004.)	No. Interface only.	RS-449 37-pin D male-to-male connectors (6' and 10'). RS-449 DTE 37-pin D to X.21 DTE 15-pin D (6').

Since the RS-449 Data Interface cannot be controlled at the front panel, no menu tree is shown.

2.3.6 DDS DS0A/B Interface



The DDS DS0A/B Interface meets Bell System Specifications for DDS testing. This interface tests DS0A or DS0B circuits transmitting at 2.4, 4.8, 9.6, 19.2 or 56 kb/s as well as clear channel 64 kb/s. It provides alternating and latching loopbacks and controls MJUs for multipoint network testing.

PATTERNS	GEN CLK SOURCE	DATA RATES	TIMING MODES	FRONT PANEL CONTROL?	CABLES/ CONNECTORS
All except FOX. Byte encoder included.	INTF only.	2.4, 4.8, 9.6, 19.2, 56, and 64 kb/s, and respective secondary channels.	SYNC only. (Switch is disabled.)	Yes.	DS0 clock cable (10') 9-pin D to 9-pin office D male OIU (10') adaptor. Bantam jacks transmit and receive.

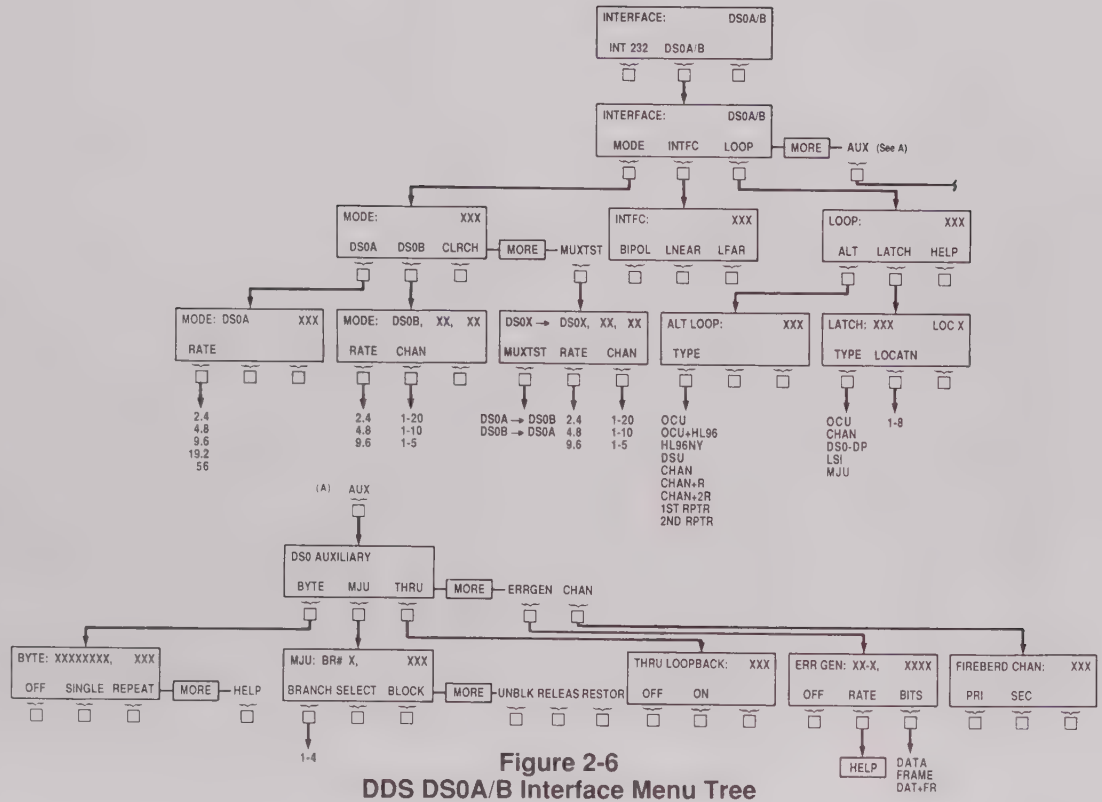
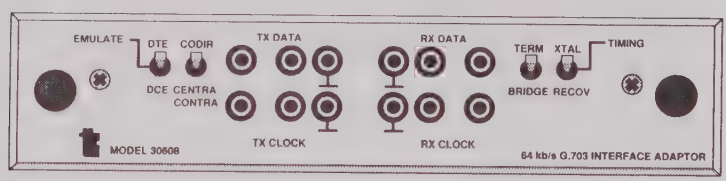


Figure 2-6
DDS DS0A/B Interface Menu Tree

2.3.7 CCITT G.703 64 kb/s Interface



The CCITT G.703 64 kb/s Interface meets CCITT G.703 64 kb/s co-directional, centralized clock, and contra-directional timing interface recommendations. A 64 kHz oscillator is provided on the interface.

PATTERNS	GEN CLK SOURCE	DATA RATES	TIMING MODES	FRONT PANEL CONTROL?	CABLES/ CONNECTORS
All synchronous patterns except FOX.	SYNTH, INTF BNC.	64kb/s.	SYNC and RECOVD only. (Switch is disabled.)	Yes.	120 ohm balanced banana jacks.

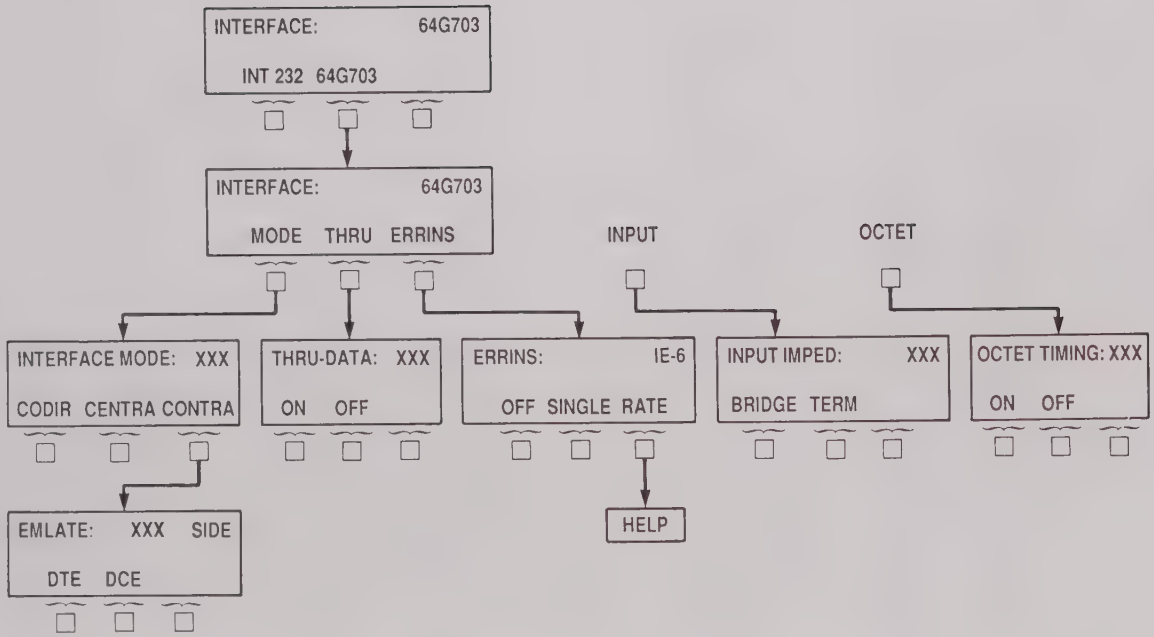
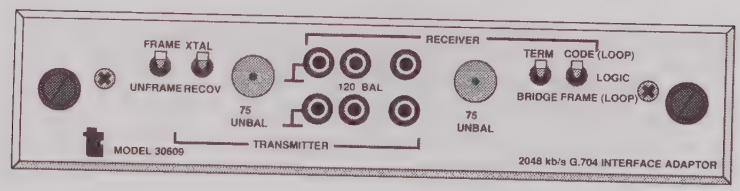


Figure 2-7
G.703 64 kb/s Interface Menu Tree

2.3.8 CCITT G.704 2048 kb/s Interface



The CCITT G.703 2048 kb/s Interface meets CCITT G.703 specifications for interfacing to equipment operating at 2048 kb/s. The interface also meets G.704 and G.732 specifications for interfacing to framed equipment.

PATTERNS	GEN CLK SOURCE	DATA RATES	TIMING MODES	FRONT PANEL CONTROL?	CABLES/ CONNECTORS
All synchronous patterns except FOX.	SYNTH, INTF BNC.	2048 kb/s.	SYNC and RECOVD only. (Switch is disabled.)	Yes.	120 ohm balanced 4mm banana jacks. 75 ohm unbalanced BNC connectors.

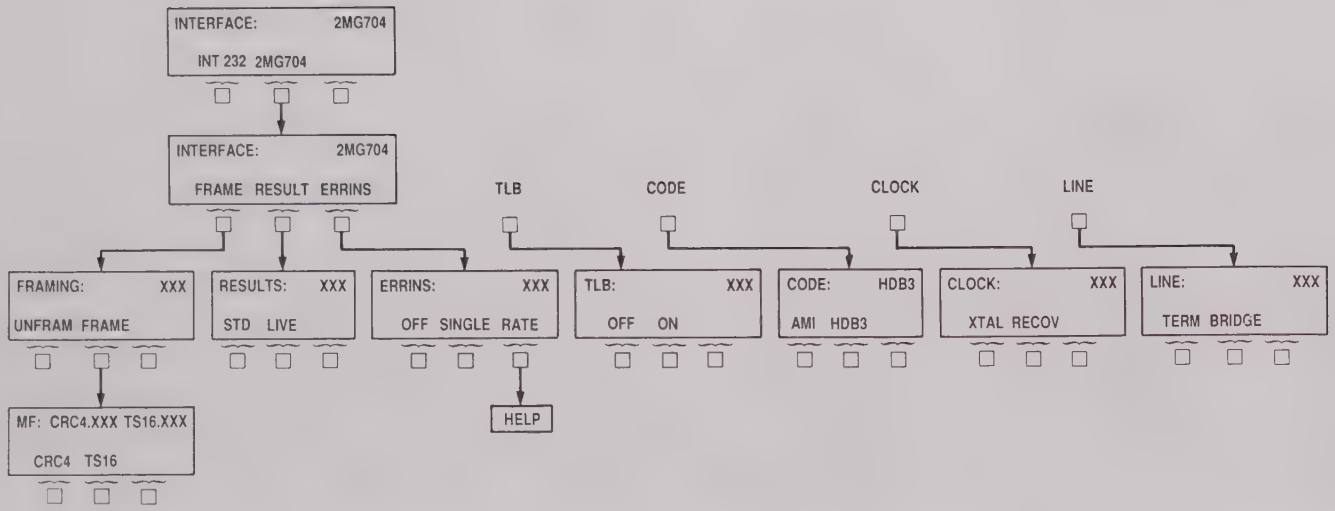
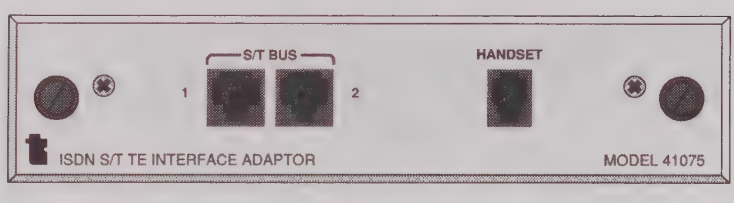


Figure 2-8
G.704 2048 kb/s Data Interface Menu Tree

2.3.12 ISDN S/T TE Interface



The ISDN S/T TE Interface evaluates the ability of a network to provide simultaneous 2B + D service and measures the quality of transmission. The interface uses Q.931 signaling on the D channel, and either digitized voice or circuit-switched data (at 56 kb/s or 64 kb/s rates) on each of the B channels.

PATTERNS	GEN CLK SOURCE	DATA RATES	TIMING MODES	FRONT PANEL CONTROL?	CABLES/ CONNECTORS
All except FOX.	INTF only. (Switch is disabled.)	56 kb/s (restricted data) or 64 kb/s (clear data).	RECOVD only. (Switch is disabled.)	Yes	RJ45 to RJ45 cable; RJ45 to alligator clips; telephone handset with 12' cord.

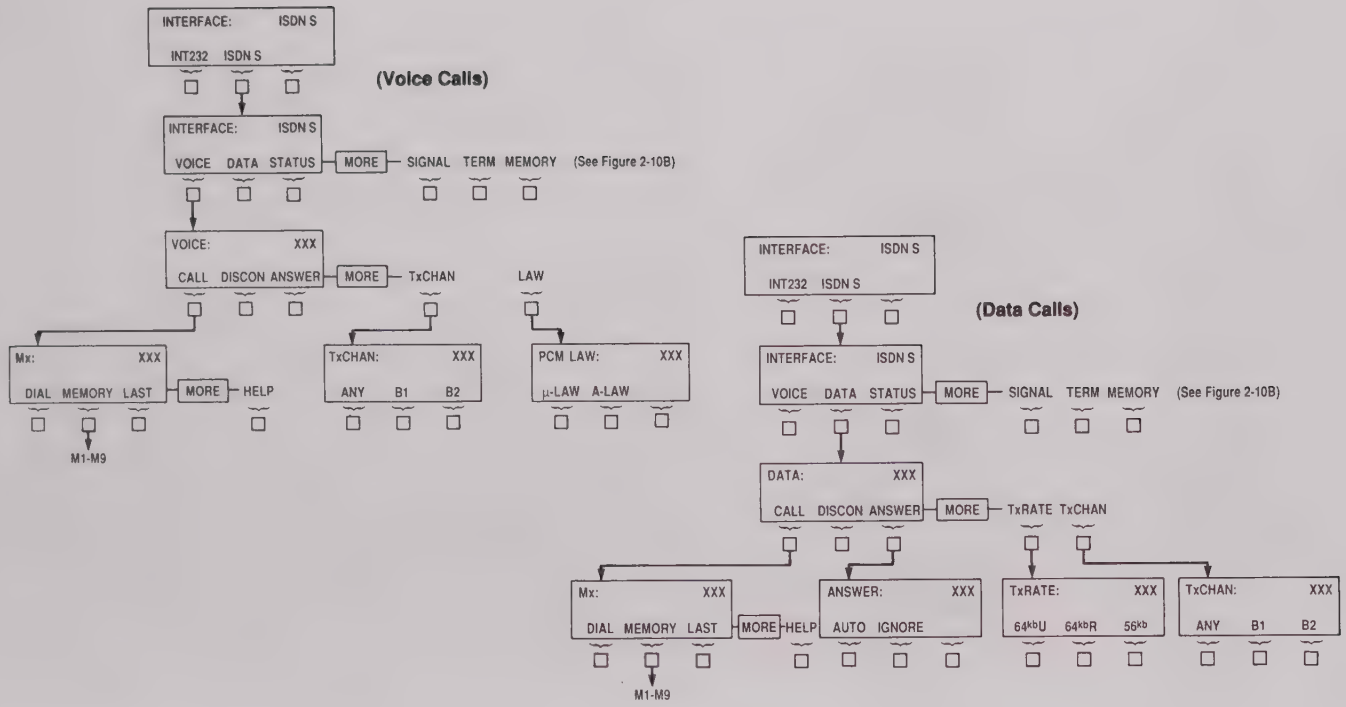
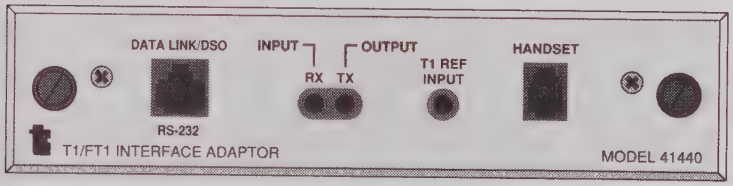


Figure 2-9
ISDN S/T TE Interface Menu Tree

2.3.9 T1/FT1 Interface

The T1/FT1 Interface complies with AT&T Publications 41541, 62411, 54016, 54019, and 54019A for T1, ESF, and fractional T1. It provides the ability to test full T1, fractional T1, voice, or the ESF data link. Other modes of operation include test loopback (TLB), line loopback (LLB), and RS-232 receive/transmit.



PATTERNS	GEN CLK SOURCE	DATA RATES	TIMING MODES	FRONT PANEL CONTROL?	CABLES/ CONNECTORS
All except FOX*, USER1*, USER2* and USER3*	INTRNL INTF BNC	1.544 Mb/s 1.536 Mb/s 64kb/s 56kb/s	RECOVD only. (Switch is disabled.)	Yes.	WECO plug to bantam plug 10', bantam plug to bantam plug 10', bantam plug to alligator clips 7', dual bantam plugs to 15-pin D-type male connector 10', RJ45 to RS-232 cable 16', RJ48C to bantam plugs 10', RJ45S to bantam plugs 10'.

*Valid pattern when the Synchronous User Patterns Option (Option 4006) is installed.

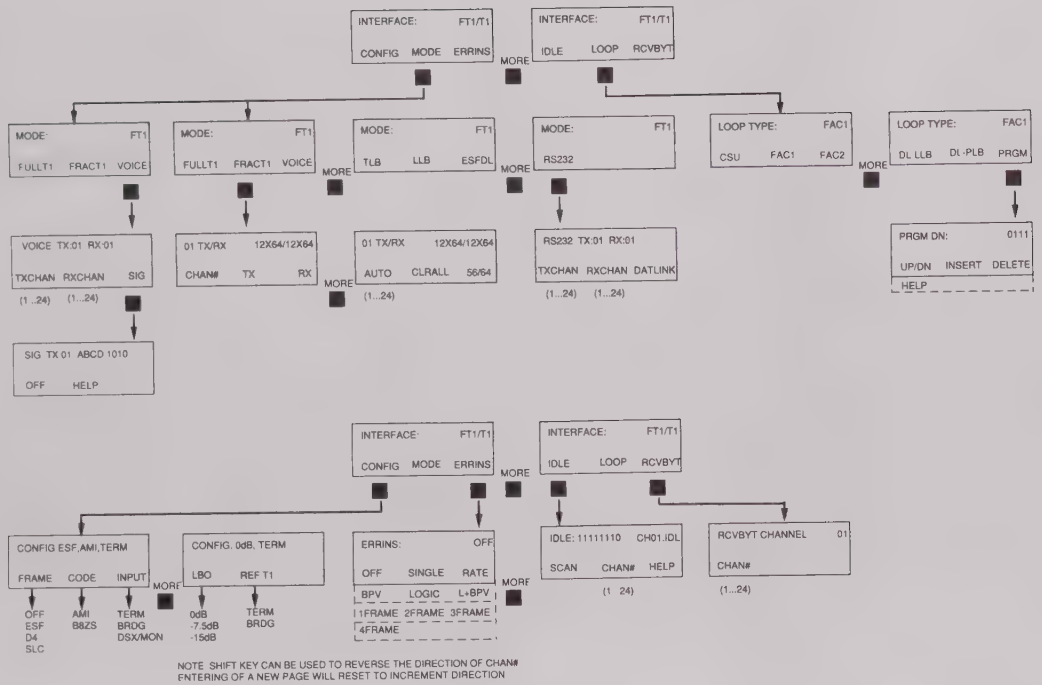
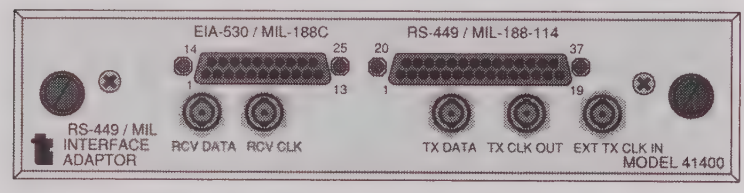


Figure 2-10
T1/FT1 Interface Menu Tree

2.3.10 MIL449 Interface

The MIL449 Interface complies with CCITT Recommendations V.10 and V.11, EIA RS-422-A, EIA RS-423-A, EIA RS-449, EIA RS-530, ISO 4902, MIL-STD-188-114, MIL-STD-188-100, and MIL-STD-188C. A 25-pin, D-type connector is used for EIA-530 and MIL-188C circuits and a 37-pin, D-type connector is used for testing RS-449 and MIL-188-114 circuits. This interface enables RS-449, MIL-188-114, EIA-530, and MIL-188C circuits to be tested and analyzed.



PATTERNS	GEN CLK SOURCE	DATA RATES	TIMING MODES	FRONT PANEL CONTROL?	CABLES/ CONNECTORS
All.	SYNC INTF BNC	20kb/s 64kb/s 15Mb/s	ASYNC SYNC	Yes.	RS-449 DTE 37-pin D-type to X.21 DTE 15-pin 6', RS-232/EIA-530/V.24 male-to-male connector 10', RS-449/530/MIL-188 37-pin D-type male-to-male 10', MIL-188 37-pin D-type male to 25-pin D-type male 6', MIL-188 37-pin D-type male to 25-pin D-type female 6'.

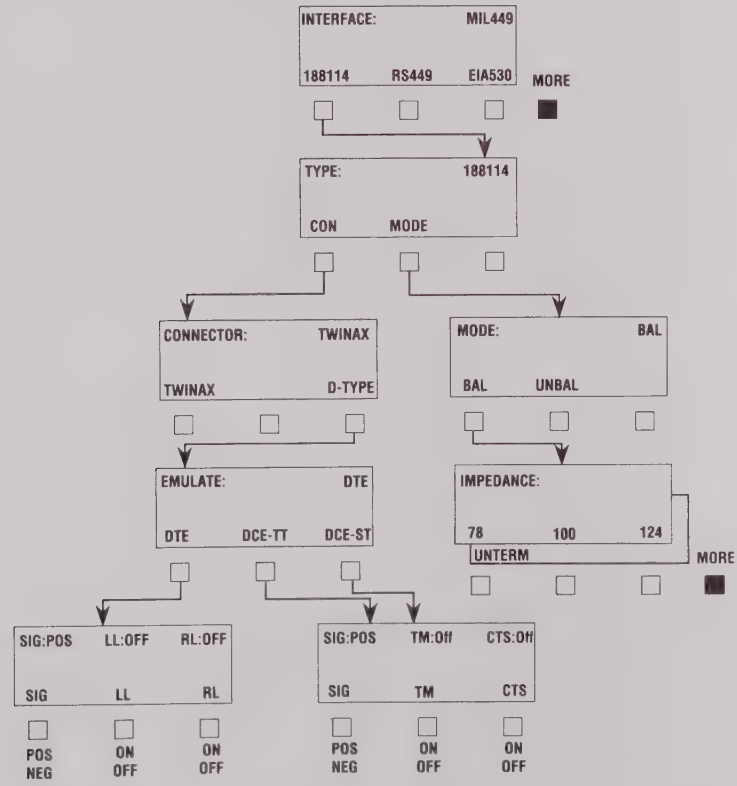


Figure 2-11 A
RS-449/530/MIL Interface Set-Up Menu
Type 118114

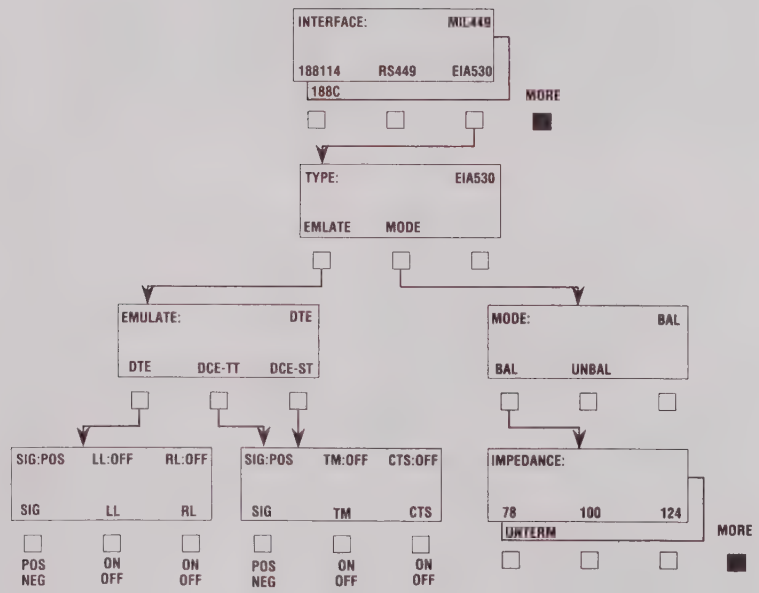


Figure 2-11 B
RS-449/530/MIL Interface Set-Up Menu
Type EIA-530

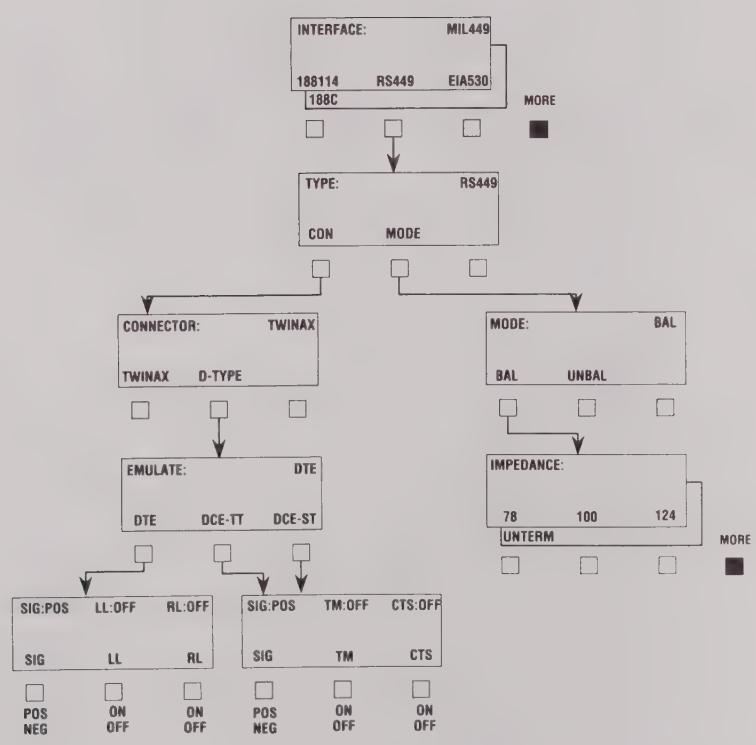


Figure 2-11 C
RS-449/530/MIL Interface Set-Up Menu
Type RS449

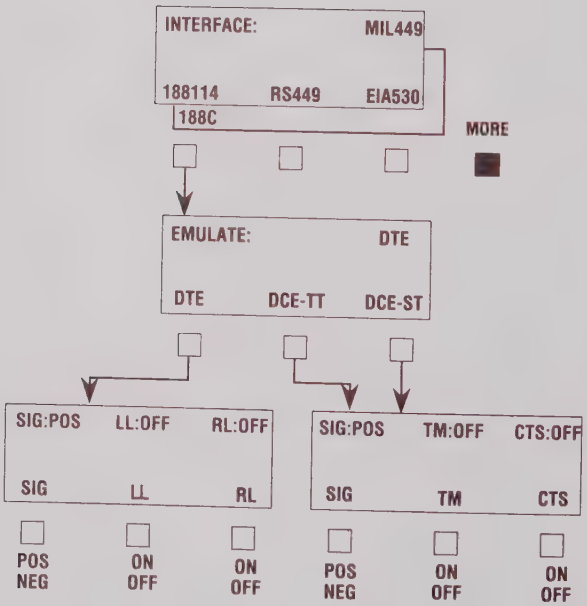
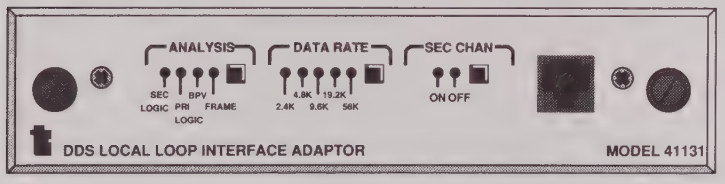


Figure 2-11 D
RS-449/530/MIL Interface Set-Up Menu
Type 188C

2.3.11 DDSLL Interface

The DDSLL Interface complies with Bellcore TA-TSY-000055, TA-TSY-000077, TA-TSY-000083, TR-NPL-000157, AT&T PUB 62120, 62310, CB126, and CB141. This interface provides the ability to test and analyze the 4-wire DDS local loop from either the customer premises or the central office. Straightaway, channel loopback, or network loopback testing can be performed using this interface.



PATTERNS	GEN CLK SOURCE	DATA RATES	TIMING MODES	FRONT PANEL CONTROL?	CABLES/ CONNECTORS
All except FOX*, USER1*, USER2*, and USER3*	INTRNL, INTF, BNC.	56 kb/s 19.2 kb/s 9.6 kb/s 4.8 kb/s 2.4 kb/s	INTF only. (Switch is disabled.)	Yes	RJ45 to RJ45 14', RJ45 to alligator (4) 10'.

*Valid pattern when the Synchronous User Patterns Option (Option 4006) is installed.

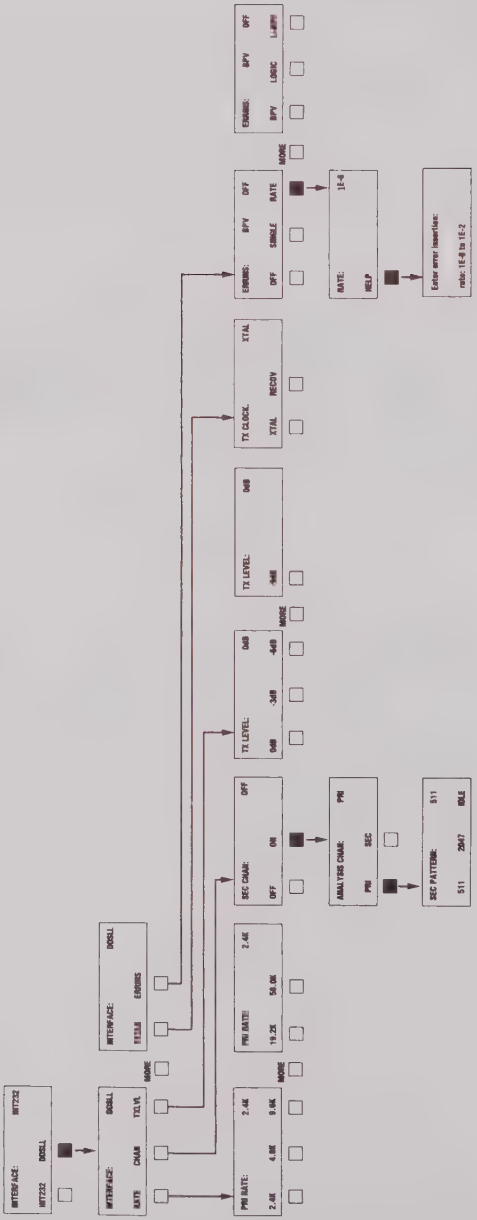


Figure 2-12
DDS Local Loop Interface Menu

SECTION 3
FIREBERD 6000 APPLICATIONS

3.1 SECTION SUMMARY

This section shows how the FIREBERD 6000 Communications Analyzer is used in a variety of common test scenarios. Scenarios and instrument set-ups are provided for synchronous, asynchronous, DDS DS0A/B, DS1/T1, and G.703 applications.

3.2 A MODEL MULTICHANNEL NETWORK

Figure 3-1 depicts a model multichannel network. This network takes customer information at a variety of rates, multiplexes them onto a high-speed link, and carries the information between the near and far ends of the network.

The sections that follow show how the FIREBERD 6000 can be used to test the various components of the multichannel network shown in Figure 3-1.

3.3 SYNCHRONOUS TESTING

3.3.1 Basic BER Testing Using the RS-232 Data Interface

Testing a 9600 b/s Modem (Local Loopback)

Figure 3-2 shows the FIREBERD 6000 and its built-in RS-232 Data Interface. The instrument is connected to a 9600 b/s modem on the terminal side of the modem. The modem has its output looped back to its own input. The FIREBERD transmits the test data to the modem and analyzes the looped-back data for errors.

The local loopback test shown in Figure 3-2 requires a single FIREBERD 6000.

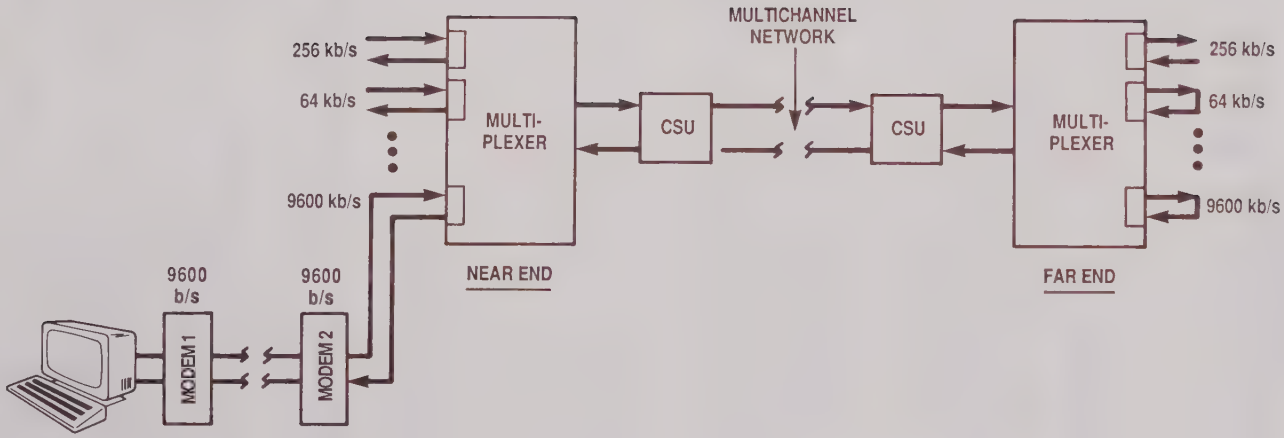


Figure 3-1
A Multichannel Network

Testing the Far-End 9600 b/s Modem (Remote Loopback)

Figure 3-3 shows the FIREBERD 6000 and its built-in RS-232 Data Interface. The instrument is connected to a 9600 b/s modem (MODEM #1). The remote-end 9600 b/s modem (MODEM #2) has its output connected to its own input to form a loop. The FIREBERD 6000 generates data and analyzes the received data for errors.

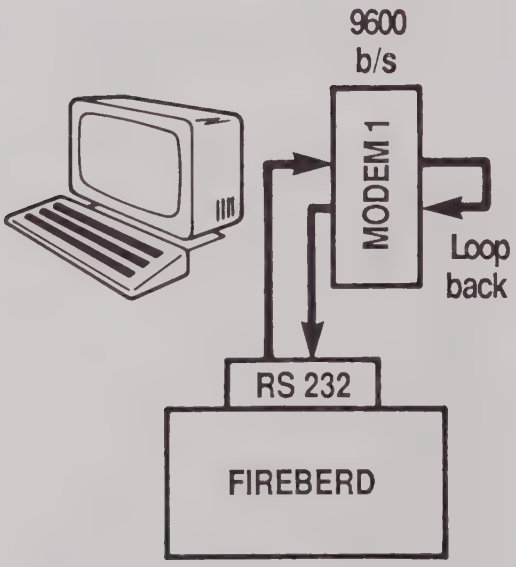


Figure 3-2
Testing a Near-End Modem Using the RS-232 Data Interface

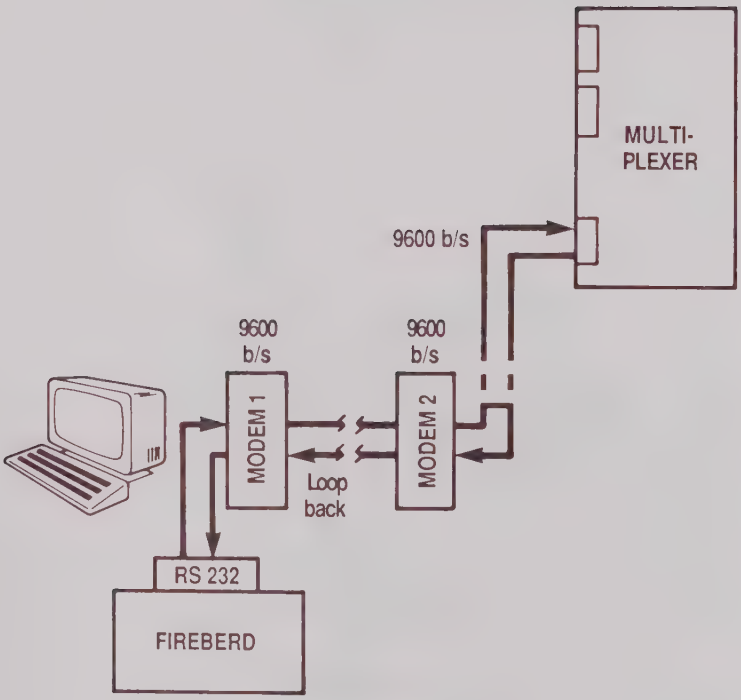


Figure 3-3
Testing a Remote-End Modem with the RS-232 Data Interface

The configuration shown above tests the local modem, the communications channel, and the far-end modem. Like local loopback testing, remote loopback testing requires a single FIREBERD 6000.

Testing the Complete Sub-Rate Channel (Remote Loopback)

Figure 3-4 shows the FIREBERD 6000 and its built-in RS-232 Data Interface connected to a 9600 b/s modem. The far-end multiplexer has its 9600 b/s sub-rate channel output connected to its own input to form a loop. The FIREBERD 6000 generates data and analyzes the received data for errors.

Testing Near- and Far-End 9600 b/s Equipment End-to-End

Figure 3-5 shows two FIREBERD 6000s, each equipped with its built-in RS-232 Data Interface. FIREBERD #1 connects to the 9600 b/s modem at the near end (MODEM #1). FIREBERD #2 connects to the 9600 b/s sub-rate multiplexer at the far end. Both instruments generate test data and analyze received data for errors in both directions. This configuration's primary asset is its ability to isolate problems in a single direction (i.e., from near-end to far-end or from far-end to near-end).

Basic RS-232 Synchronous Test Set-Up

Here is a table which describes the FIREBERD 6000 set-up procedures for the four basic bit error rate tests described in this section. Although these procedures specifically apply to the testing of modems and multiplexers, you can use them to set up any basic RS-232 synchronous test.

IMPORTANT: If your test fails to run after completing these set-up procedures, Section 3.3.5 offers additional information about synchronous testing.

Table 3-1
RS-232 Synchronous Test Set-Up

STEP:	ACTIVITY:
1.	Press the POWER switch to apply power to the FIREBERD 6000. **NOTE:** If the FIREBERD 6000 is in Self-Loop mode after power-up, disengage the SELF LOOP switch.
2.	Set the DATA switch to the 63, 511, or 2047 position.
3.	Set the GEN CLK switch to the INTF position to receive the clock from the DCE.
4.	Set the TIMING MODE switch to the SYNC position.
5.	Using the MENU switch: a. Configure the RS-232 Data Interface using INTF SETUP.

Table 3-1
RS-232 Synchronous Test Set-Up (Continued)

STEP:	ACTIVITY:
5. (cont.)	Make these selections by pressing the MENU soft keys underneath their display: 1. INT 232 to select the RS-232 Data Interface. 2. EMLATE to access the emulation menu. 3. DTE to select DTE emulation. b. If a timed test is desired, do the following: 1. Set the MENU switch to TEST INTERVAL. 2. Press the MORE key twice, then press the TIMED soft key. 3. Set the desired test length using the MENU keypad, then press the ENTER key. 4. Set the ANALYSIS MODE switch (located to the right of the RESULTS area) to SINGLE. If a continuous test is desired: 1. Set the MENU switch to TEST INTERVAL. 2. Set the desired measurement interval (default setting: 10^5), then press the ENTER key. 3. Set the ANALYSIS MODE switch (located to the right of the RESULTS area) to CONTINUOUS. c. If hard-copy test results are desired, set the print event criteria using PRINT EVENT, then enable the printer control block (located to the left of the POWER switch) by setting the OFF/ON switch to the ON position. **Sample Print Event Soft Key Sequence:** 1. NORMAL to specify standard test results. 2. ERROR to access error printout menu. 3. BLKERR to print on occurrence of block errors. 4. ▲ SYNLOS to access synchronization loss menu. 5. ON to print on synchronization loss. 6. ▲ MORE ▬ TESINT to access test interval menu. 7. ON to print at the end of each test interval.
6.	Illuminate the RTS and DTR switches located just above the POWER switch to set both signaling leads HIGH.
7.	Using the appropriate cables, connect the FIREBERD 6000 to the equipment under test.
8.	Check that the SYNC LED located at the upper right-hand corner of the FIREBERD 6000 is illuminated. **RESULT:** The FIREBERD has achieved pattern synchronization, and is gathering test results. (Section 3.3.4 lists all synchronous test results.)

Legend
▲ Press the Up-Arrow key
▬ Press the More key to access the next menu.

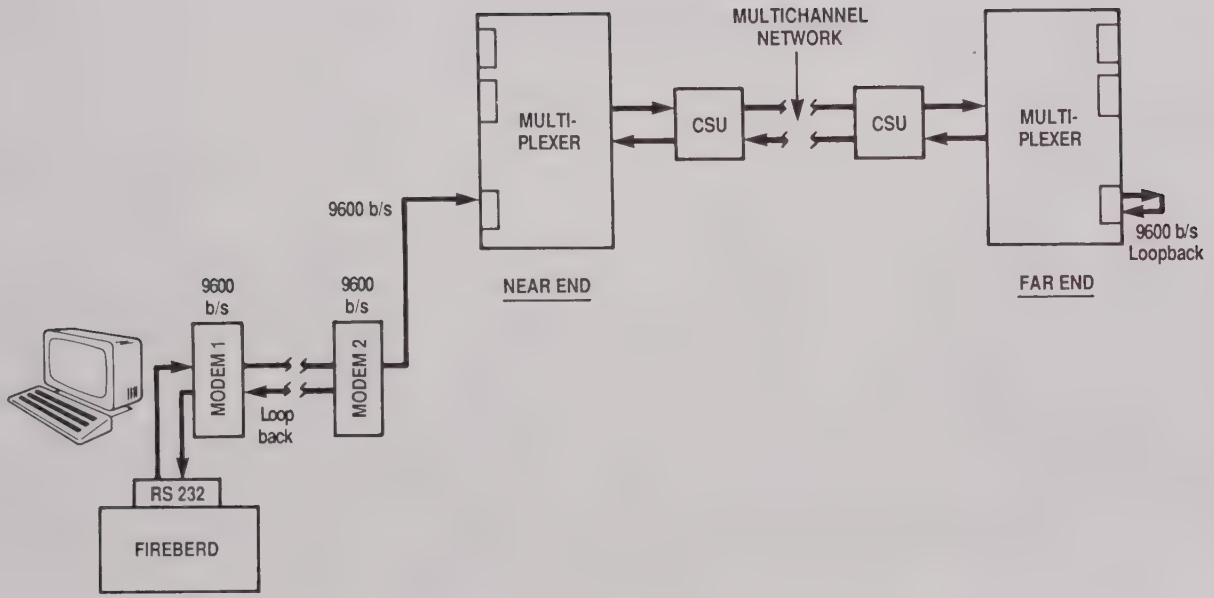


Figure 3-4
Testing a Far-End Sub-Rate Channel Using the RS-232 Data Interface

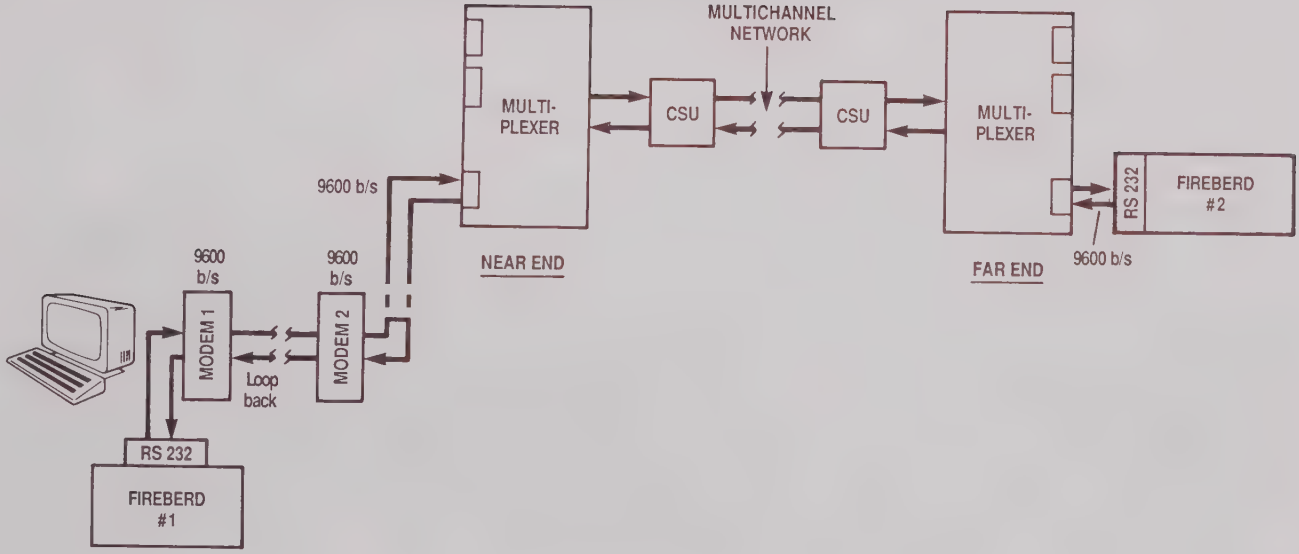


Figure 3-5
Testing Near- and Far-End Equipment End-to-End Using the RS-232 Data Interface

3.3.2 Basic BER Testing Using the RS-449 (V.10/V.11) Data Interface

Testing the 256 kb/s Sub-Rate Channel of the T-1 Multiplexer (Local Loopback)

Figure 3-6 shows a FIREBERD 6000 equipped with an RS-449 Data Interface. The instrument is connected to a 256 kb/s subrate channel of a multiplexer on the near side. The multiplexer has its output looped back to its own input. The FIREBERD 6000 both transmits the test data and analyzes the received data for errors.

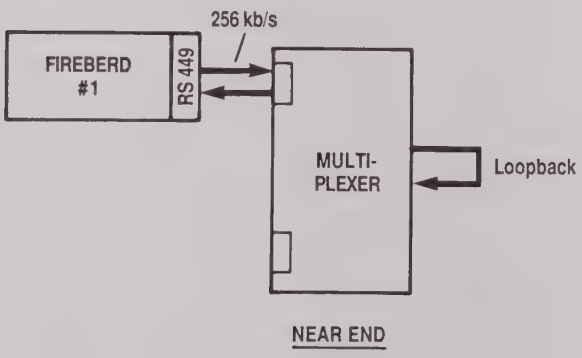


Figure 3-6
Testing a 256 kb/s Sub-Rate Channel Using the RS-449 Data Interface

Testing Near- and Far-End 256 kb/s Equipment Simultaneously (End-to-End Testing)

Figure 3-7 shows two FIREBERD 6000s, each equipped with an RS-449 Data Interface. FIREBERD #1 connects to the 256 kb/s sub-rate channel of the multiplexer at the near end. FIREBERD #2 connects to the 256 kb/s sub-rate channel of the multiplexer at the far end. Both instruments simultaneously generate test data and analyze received data for errors in both directions.

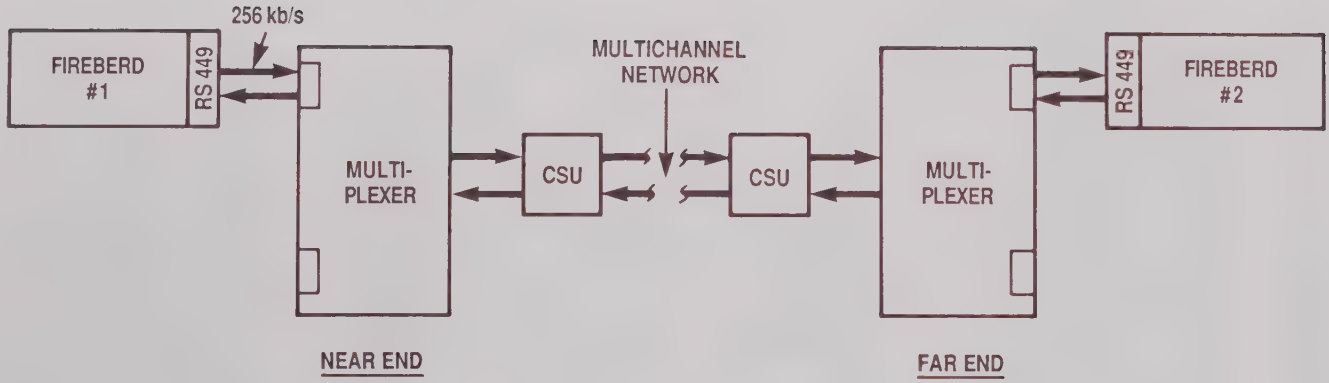


Figure 3-7
Testing Near- and Far-End 256 kb/s Equipment Simultaneously Using the RS-449 Data Interface

The test results obtained in this configuration reflect the quality of all the lines and equipment between the two FIREBERDs.

Basic RS-449 Synchronous Test Set-Up

Here is a table which describes the FIREBERD 6000 set-up procedures for the two basic bit error rate tests described in this section. Although these procedures specifically apply to the testing of multiplexer equipment, you can use them to set up any basic RS-449 synchronous test.

IMPORTANT: If your test fails to run after completing these set-up procedures, Section 3.3.5 offers additional information about synchronous testing.

Table 3-2
RS-449 Synchronous Test Set-Up

STEP:	ACTIVITY:
1.	With the power to the FIREBERD turned off, insert the RS-449 Data Interface in the designated rear-panel slot.
2.	Press the POWER switch to apply power to the FIREBERD 6000. **NOTE:** If the FIREBERD 6000 is in Self-Loop mode after power-up, disengage the SELF LOOP switch.
3.	Select a test data pattern using the DATA switch. **NOTE:** If you're testing a 256 kb/s subrate channel as shown in this section, select either the 511 or the 2047 data pattern.
4.	Set the GEN CLK switch to the INTF position to receive the clock from the DCE.
5.	Set the TIMING MODE switch to the SYNC position.
6.	Using the MENU switch: a. The RS-449 Data Interface is not controllable via the FIREBERD 6000 front panel. *Select* the RS-449 Data Interface using INTF SETUP. *Configure* the RS-449 Data Interface using the switches on the interface as follows: **Standard Set-Up:** 1. 422 TERM/422 UNTERM/423 switch to 422 TERM. 2. TRANSMIT CLOCK INVERT switch to RCV NORM RI. OFF. 3. DCE TT/DTE/DCE ST switch to DTE. 4. RECEIVE CLOCK INVERT switch to TX NORM LL OFF. b. If a timed test is desired, do the following: 1. Set the MENU switch to TEST INTERVAL. 2. Press the MORE key twice, then press the TIMED soft key.

Table 3-2
RS-449 Synchronous Test Set-Up (Continued)

STEP:	ACTIVITY:
6. (cont.)	3. Set the desired test length using the MENU keypad, then press the ENTER key. 4. Set the ANALYSIS MODE switch (located to the right of the RESULTS area) to SINGLE. If a continuous test is desired: 1. Set the MENU switch to TEST INTERVAL. 2. Set the desired measurement interval (default setting: 10^5), then press the ENTER key. 3. Set the ANALYSIS MODE switch (located to the right of the RESULTS area) to CONTINUOUS. c. If hard-copy test results are desired, set the print event criteria using PRINT EVENT, then enable the printer control block (located to the left of the POWER switch) by setting the OFF/ON switch to the ON position. **Sample Print Event Soft Key Sequence:** 1. NORMAL to specify standard test results. 2. ERROR to access error printout menu. 3. BLKERR to print on occurrence of block errors. 4. ▲ SYNLOS to access synchronization loss menu. 5. ON to print on synchronization loss. 6. ▲ More TESINT to access test interval menu. 7. ON to print at the end of each test interval. **RESULT:** The FIREBERD 6000 generates a printout on the occurrence of a block error, loss of synchronization, and at the end of each test interval.
7.	Illuminate the RTS and DTR switches located just above the POWER switch to set both signaling leads HIGH.
8.	Using the appropriate cables, connect the FIREBERD 6000 to the equipment under test.
9.	Check that the SYNC LED located at the upper right-hand corner of the FIREBERD 6000 is illuminated. **RESULT:** The FIREBERD has achieved pattern synchronization, and is gathering test results. (Section 3.3.4 lists all synchronous test results.)

Legend
▲ Press the Up Arrow key
More Press the More key to access the next menu

3.3.3 Basic BER Testing Using the V.35 Data Interface

Testing a Far-End 64 kb/s Sub-Rate Channel (Remote Loopback)

Figure 3-8 shows a FIREBERD 6000 equipped with a V.35 Data Interface. The instrument is connected to a 64 kb/s sub-rate channel of a multiplexer on the near side. The far-end multiplexer has its 64 kb/s sub-rate channels output connected to its own input to form a loop. The FIREBERD 6000 generates data and analyzes the received data for errors.

Basic V.35 Synchronous Test Set-Up

Here is a table which describes the FIREBERD 6000 set-up procedures for the basic bit error rate test described in this section. Although these procedures specifically apply to the testing of 64 kb/s equipment, you can use them to set up any basic V.35 synchronous test.

IMPORTANT: If your test fails to run after completing these set-up procedures, Section 3.3.5 offers additional information about synchronous testing.

Table 3-3
V.35 Synchronous Test Set-Up

STEP:	ACTIVITY:
1.	With the power to the FIREBERD turned off, insert the V.35 Data Interface in the designated rear-panel slot.
2.	Press the POWER switch to apply power to the FIREBERD 6000. **NOTE:** If the FIREBERD 6000 is in Self-Loop mode after power-up, disengage the SELF LOOP switch.
3.	Select a test data pattern using the DATA switch. **NOTE:** The recommended patterns for testing a 64 kb/s subrate channel are 511 or 2047.
4.	Set the GEN CLK switch to the INTF position to receive the clock from the DCE.
5.	Set the TIMING MODE switch to the SYNC position.
6.	Using the MENU switch: a. The V.35 Data Interface is not controllable via the FIREBERD 6000 front panel. *Select* the V.35 Data Interface using INTF SETUP. *Configure* the V.35 Data Interface using the switches on the interface as follows:

Table 3-3
V.35 Synchronous Test Set-Up (Continued)

STEP:	ACTIVITY:
6. (cont.)	**Standard Set-Ups:** 1. TRANSMIT CLOCK INVERT switch to NORMAL. 2. RECEIVE CLOCK INVERT switch to NORMAL. 3. TIMING MODE switch to 306. b. If a timed test is desired, do the following: 1. Set the MENU switch to TEST INTERVAL. 2. Press the MORE key twice, then press the TIMED soft key. 3. Set the desired test length using the MENU keypad, then press the ENTER key. 4. Set the ANALYSIS MODE switch (located to the right of the RESULTS area) to SINGLE. If a continuous test is desired: 1. Set the MENU switch to TEST INTERVAL. 2. Set the desired measurement interval (default setting: 10^5), then press the ENTER key. 3. Set the ANALYSIS MODE switch (located to the right of the RESULTS area) to CONTINUOUS. c. If hard-copy test results are desired, set the print event criteria using PRINT EVENT, then enable the printer control block (located to the left of the POWER switch) by setting the OFF/ON switch to the ON position. **Sample Print Event Soft Key Sequence:** 1. NORMAL to specify standard test results. 2. ERROR to access error printout menu. 3. BLKERR to print on occurrence of block error. 4. ▲ SYNLOS to access synchronization loss menu. 5. ON to print on synchronization loss. 6. ▲ MORE ▬ TESINT to access test interval menu. 7. ON to print at the end of each test interval. **RESULT:** The FIREBERD 6000 generates a printout on the occurrence of a block error, loss of synchronization, and at the end of each test interval.
7.	Illuminate the RTS and DTR switches located just above the POWER switch to set both signaling leads HIGH.
8.	Using the appropriate cables, connect the FIREBERD 6000 to the equipment under test.
9.	Check that the SYNC LED located at the upper right-hand corner of the FIREBERD 6000 is illuminated. **RESULT:** The FIREBERD has achieved pattern synchronization, and is gathering test results. (Section 3.3.4 lists all synchronous test results.)

Legend

▲ Press the Up Arrow key

▬ Press the More key to access the next menu.

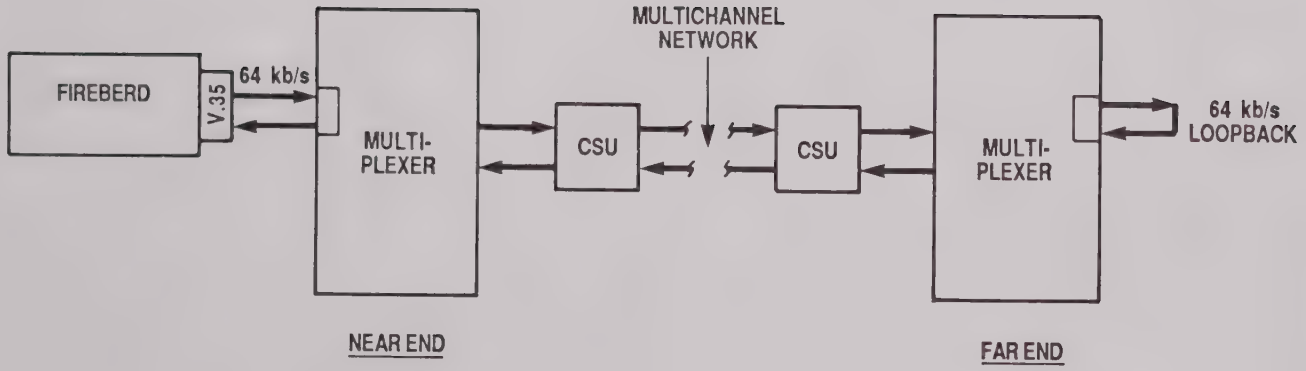


Figure 3-8
Testing a 64 kb/s Sub-Rate Channel Using the V.35 Data Interface

3.3.4 Synchronous Test Results

Here are the significant synchronous test results that are available with the RS-232, RS-449, and V.35 Data Interfaces. These results can be collected via printer or can be viewed at the ANALYSIS display windows.

Table 3-4
Synchronous Test Results

CATEGORY:	RESULTS:		
ERROR	BER AVG BLER AVG BER	BLOCKS CLK SLIP	BLK ERRS BIT ERRS
PERFORMANCE	ERR SEC DEG MIN %SES %AVL SEC	EFS %DEG MIN UNA SEC SYNL SEC	%EFS SES AVL SEC %SYN SEC
TIME	ERR EAS ELAP SEC	E A SEC TIME	E F EAS DATE
SIGNAL	DELAY	RCV FREQ	GEN FREQ
T-CARRIER	T-Carrier measurements are not applicable.		
ALARM	SYN LOSS C-D CHA	DAT LOSS PWR LOSS	CLK LOSS

Appendix B offers a glossary of all significant test results available with the FIREBERD 6000.

3.3.5 Notes on Synchronous Testing

If your test fails to run after completing the set-up procedures for your synchronous application, the sections that follow may lead you to the solution. Note that only the most likely potential problem areas are addressed; if your test still fails to run after exploring these possibilities, call TTC's toll-free number (1-800-638-2049) for technical assistance.

Flow Control

Data pattern transmission can be inhibited when the out-of-band flow control setting on the FIREBERD 6000 conflicts with the requirements of your specific application.

Out-of-band flow control is specified using Auxiliary Function 08. If your application does *not* require the implementation of out-of-band flow control, make sure Auxiliary Function 08 is turned OFF. If your specific

application requires the implementation of out-of-band flow control, turn Auxiliary Function 08 ON and identify the signals that enable data transmission.

Non-Availability of the Selected Timing Source

If the **GEN CLK** switch is illuminated when set to the INTF position, it means that the selected timing source is not available to the FIREBERD 6000. In such instances, check your cables to ensure that they are properly connected. If the **GEN CLK** switch is still illuminated after checking your cables, do the following:

1. Reset the **GEN CLK** switch to the SYNTH position.
2. Using the **MENU** switch, set the synthesizer frequency to the desired rate (e.g., 64 for 64 kb/s testing) using SYNTH FREQ and the appropriate soft key.

Setting Auxiliary Functions

Sometimes the setting of one of the auxiliary functions may not be in agreement with the specifics of your application. Use Auxiliary Function 99 to reset all of your auxiliary functions to their default states.

CAUTION: The use of this function resets any auxiliary functions that were intentionally set when previously configuring the FIREBERD 6000.

3.4 ASYNCHRONOUS TESTING

3.4.1 Asynchronous Testing Using the RS-232 Data Interface

Testing a 1200 b/s Asynchronous Modem (Local Loopback)

Figure 3-9 shows a FIREBERD 6000 with its built-in RS-232 data interface. The instrument is connected to a 1200 b/s modem. The modem has its output looped back to its own input. The FIREBERD 6000 both transmits the test data and analyzes the received data for errors.

NOTE: Asynchronous testing can also be performed using the RS-449 and V.35 Data Interfaces.

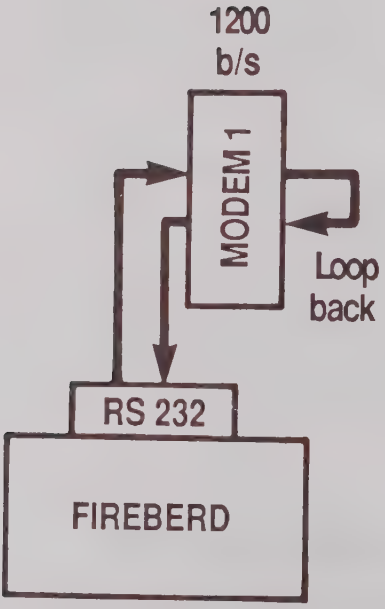


Figure 3-9
Testing an Asynchronous Modem Using the
RS-232 Data Interface

3.4.2 RS-232 Asynchronous Test Set-Up

Here is a table which describes the FIREBERD 6000 set-up procedures for the asynchronous test described in this section. Although these procedures specifically apply to the testing of modem equipment, you can use them to set up any basic RS-232 asynchronous test.

IMPORTANT: If your test fails to run after completing these set-up procedures, Section 3.4.4 offers additional information about asynchronous testing.

Table 3-5
RS-232 Asynchronous Test Set-Up

STEP:	ACTIVITY:
1.	Press the POWER switch to apply power to the FIREBERD 6000. **NOTE:** If the FIREBERD 6000 is in Self-Loop mode after power-up, disengage the SELF LOOP switch.
2.	Select a test data pattern using the DATA switch. **NOTE:** The recommended pattern for asynchronous testing is FOX.
3.	Set the GEN CLK switch to the SYNTH position.
4.	Set the TIMING MODE switch to the ASYNC position.
5.	Using the MENU switch: a. Set the synthesizer frequency to the desired baud rate (e.g., 1.2 for 1200 b/s testing) using SYNTH FREQ and the appropriate soft key (or keypad if the desired baud rate is not a part of the soft key menu). b. Configure the RS-232 Data Interface using INTF SETUP. Select these MENU soft keys: 1. INT 232 to select the RS-232 Data Interface. 2. EMLATE to access emulation menu. 3. DTE to select DTE emulation. c. Select the desired asynchronous character format using CHAR FORMAT. Select these MENU soft keys: **Sample Character Format Set-Up:** Select: 1. DATA to access the data bit menu. 2. 7 to select seven data bit format. 3. ▲ PARITY to access the parity menu. 4. EVEN to select even parity. 5. ▲ STOP to access stop bit menu. 6. 1 to select one stop bit.

Legend
▲ Press the Up-Arrow key
▬ Press the More key to access the next menu.

Table 3-5
RS-232 Asynchronous Test Set-Up (Continued)

STEP:	ACTIVITY:
5. (cont.)	d. If a timed test is desired, do the following: 1. Set the MENU switch to TEST INTERVAL. 2. Press the MORE key twice, then press the TIMED soft key. 3. Set the desired test length using the MENU keypad, then press the ENTER key. 4. Set the ANALYSIS MODE switch (located to the right of the RESULTS area) to SINGLE. If a continuous test is desired: 1. Set the MENU switch to TEST INTERVAL. 2. Set the desired measurement interval (default setting: 10^5), then press the ENTER key. 3. Set the ANALYSIS MODE switch (located to the right of the RESULTS area) to CONTINUOUS. e. If hard-copy test results are desired, set the print event criteria using PRINT EVENT, then enable the printer control block (located to the left of the POWER switch) by setting the OFF/ON switch to the ON position. **Sample Print Event Soft Key Sequence:** 1. NORMAL to specify standard test results. 2. ERROR to access error printout menu. 3. BITERR to print on occurrence of bit errors. 4. ▲ SYNLOS to access synchronization loss menu. 5. ON to print on synchronization loss. 6. ▲ MORE TESINT to access test interval menu. 7. ON to print at the end of each test interval. **RESULT:** The FIREBERD 6000 generates a printout on the occurrence of a character error, loss of synchronization, and at the end of each test interval.
6.	Using the appropriate cables, connect the FIREBERD 6000 to the equipment under test.
7.	Illuminate the RTS and DTR switches located just above the POWER switch to set both signaling leads HIGH.
8.	Check that the SYNC LED located at the upper right-hand corner of the FIREBERD 6000 is illuminated. **RESULT:** The FIREBERD has achieved pattern synchronization, and is gathering test results. (Section 3.4.3 lists all asynchronous test results.)

3.4.3 Asynchronous Test Results

Here are the asynchronous test results that are available with the RS-232, RS-449, and V.35 Data Interfaces. These results can be collected via printer or can be viewed at the ANALYSIS display window at the conclusion of any test.

Table 3-6
Asynchronous Test Results

CATEGORY:	RESULTS:		
ERROR	BIT ERRS BLOCKS CHAR ERR	AVG BER BLK ERRS	BER AVG BLER
PERFORMANCE	SYNL SEC	%SYN SEC	
TIME	ERR EAS ELAP SEC	E A SEC TIME	E F EAS DATE
SIGNAL	GEN FREQ	DELAY	
T-CARRIER	T-Carrier results are not applicable.		
ALARM	SYN LOSS	DAT LOSS	PWR LOSS

Appendix B offers a glossary of all significant test results available with the FIREBERD 6000.

3.4.4 Notes on Asynchronous Testing

If your test fails to run after completing the set-up procedures for your asynchronous application, the sections that follow may lead you to the solution. Note that only the most likely potential problem areas are addressed; if your test still fails to run after exploring these possibilities, call TTC's toll-free number (1-800-638-2049) for technical assistance.

Flow Control

Data pattern transmission can be inhibited when the flow control setting on the FIREBERD 6000 conflicts with the requirements of your specific application.

In-band and out-of-band flow control is specified using auxiliary functions 08 and 09, respectively. If your application does *not* require the implementation of out-of-band flow control, make sure auxiliary functions 08 and 09 are both turned OFF. If your specific application requires the implementation of either in-band or out-of-band flow control, turn the appropriate auxiliary function ON and identify the conditions for data transmission.

Setting Auxiliary Functions

Sometimes the setting of one of the auxiliary functions may not agree with the specifics of your application. Use Auxiliary Function 99 to reset all of your auxiliary functions to their default states.

CAUTION: The use of this function resets any auxiliary functions that were intentionally set when previously configuring the FIREBERD 6000.

3.5 DDS TESTING AT THE DS0 LEVEL

Using the DDS DS0A/B Interface, the FIREBERD 6000 can isolate DDS circuit problems occurring at (or between) various DDS network components such as DSUs, CSUs, OCUs, DS0-DPs, MJUs and SRDMs. Error analysis can be performed via straightaway tests and latching or alternating loopback tests.

An 8 kHz byte clock and a 64 kHz bit clock are required for all DDS testing. Both are normally obtained from the DDS channel bank, and are typically connected by an A-5 connector or a 9-pin D connector; the DDS DS0A/B Interface accepts the 9-pin D connector.

3.5.1 Testing a 19.2 kb/s Circuit (OCU Latching Loopback)

Figure 3-10 shows a FIREBERD 6000 equipped with a DDS DS0A/B Interface. Using an OCU latching loop for the far-end OCU, the instrument loops back the OCU and performs a 19.2 kb/s test of the circuit.

NOTE: If the OCU does not respond to the latching loop code, try the alternating loop code.

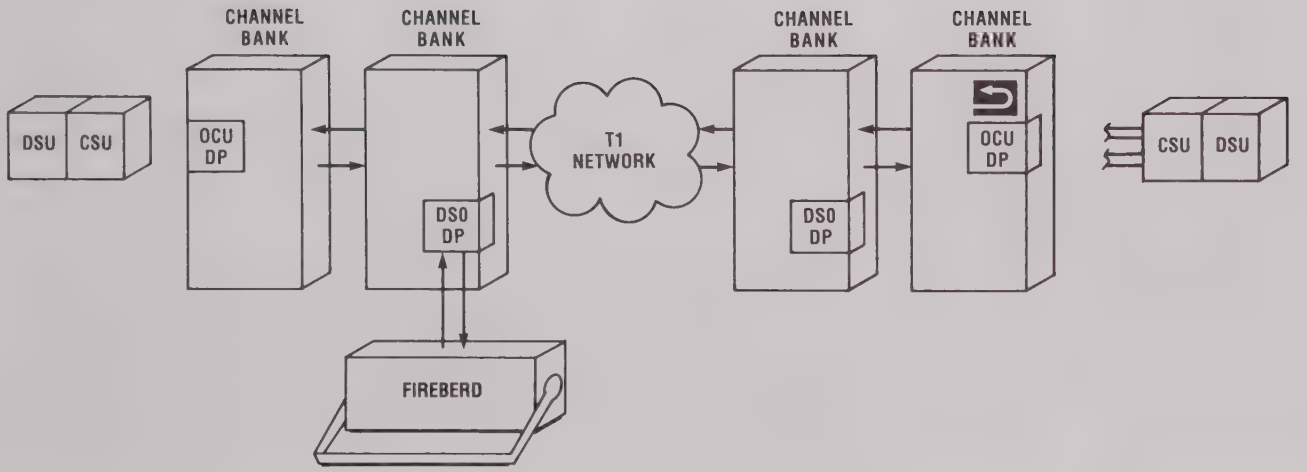


Figure 3-10
Far-End OCU Loopback

Basic Far-End OCU Loopback Test Set-Up

Here is a table which describes how the FIREBERD 6000 can be set up to perform a far-end OCU loopback test. Although these procedures apply specifically to 19.2 kb/s testing, you can use them to set up any far-end OCU latching loopback test.

IMPORTANT: If your test fails to run after completing these set-up procedures, Section 3.5.5 offers additional information about DS0 testing.

Table 3-7
Far-End OCU Loopback Test Set-Up

STEP:	ACTIVITY:
1.	With the power to the FIREBERD turned off, insert the DDS DS0A/B Interface in the designated rear-panel slot.
2.	Press the POWER switch to apply power to the FIREBERD 6000. **NOTE:** If the FIREBERD 6000 is in Self-Loop mode after power-up, disengage the SELF LOOP switch.
3	Set the DATA switch to the 63, 511, or 2047 position.
4.	GEN CLK defaults to the INTF position.
5.	Using the MENU switch: a. Configure the DDS DS0A/B Interface using INTF SETUP. Select these soft keys: 1. DS0A/B to select the DS0A/B Interface. 2. MODE to select the data format. 3. DS0A to select the DS0A format. 4. RATE to scroll through the selections to 19.2 kb/s. 5. ▲ ▲ INTFC to access the data coding. 6. BIPOLAR to select bipolar encoding. 7. ▲ LOOP to access the loop selections. 8. LATCH to select latching loops. 9. TYPE to scroll through the selections to OCU. 10. LOCATN to scroll through the selections to location 1. b. If a timed test is desired, do the following: 1. Set the MENU switch to TEST INTERVAL. 2. Press the MORE key twice, then press the TIMED soft key. 3. Set the desired test length using the MENU keypad, then press the ENTER key. 4. Set the ANALYSIS MODE switch (located to the right of the RESULTS area) to SINGLE. If a continuous test is desired: 1. Set the MENU switch to TEST INTERVAL. 2. Set the desired measurement interval (default setting: 10^5), then press the ENTER key. 3. Set the ANALYSIS MODE switch (located to the right of the RESULTS area) to CONTINUOUS.

Legend

▲ Press the Up-Arrow key

MORE Press the More key to access the next menu.

Table 3-7
Far-End OCU Loopback Test Set-Up (Continued)

STEP:	ACTIVITY:
5. (continued)	**Sample Print Event Soft Key Sequence:** 1. NORMAL to specify standard test results. 2. TIME to access the time menu. 3. 15 (using MENU keypad and ENTER key) to obtain a results print every 15 minutes. 4. SYNLOS to access synchronization loss menu. 5. ON to print on synchronization loss. **RESULT:** The FIREBERD 6000 generates a printout every 15 minutes, and on the occurrence of synchronization loss.
6.	Using the appropriate cables, connect the FIREBERD 6000 to the DS0-DP, and to the bit and byte clocks (see Section 3.5).
7.	Once the FIREBERD 6000 is configured properly and cabled to the circuit, the loop code sequence is initiated to establish a loopback by pressing the LOOP UP button on the bottom right corner of the front panel. The display will read "Transmitting loop code. Please wait . . ." **IMPORTANT:** Press LOOP DOWN at the end of the test to remove the loopback and to return the circuit to normal operation.
8.	Check that the SYNC LED located at the upper right-hand corner of the FIREBERD 6000 is illuminated. **RESULT:** The FIREBERD has achieved pattern synchronization, and is gathering test results. (Section 3.5.4 lists all DDS DS0A/B test results.)

3.5.2 Testing a 56 kb/s Multipoint Circuit (DSU Loopback)

Figure 3-11 shows a FIREBERD 6000 equipped with a DDS DS0A/B Interface. After isolating one transmission path within the multipoint circuit by using the necessary MJU control codes, the instrument creates a far-end DSU loopback to test a 56 kb/s circuit using the appropriate DSU loop code.

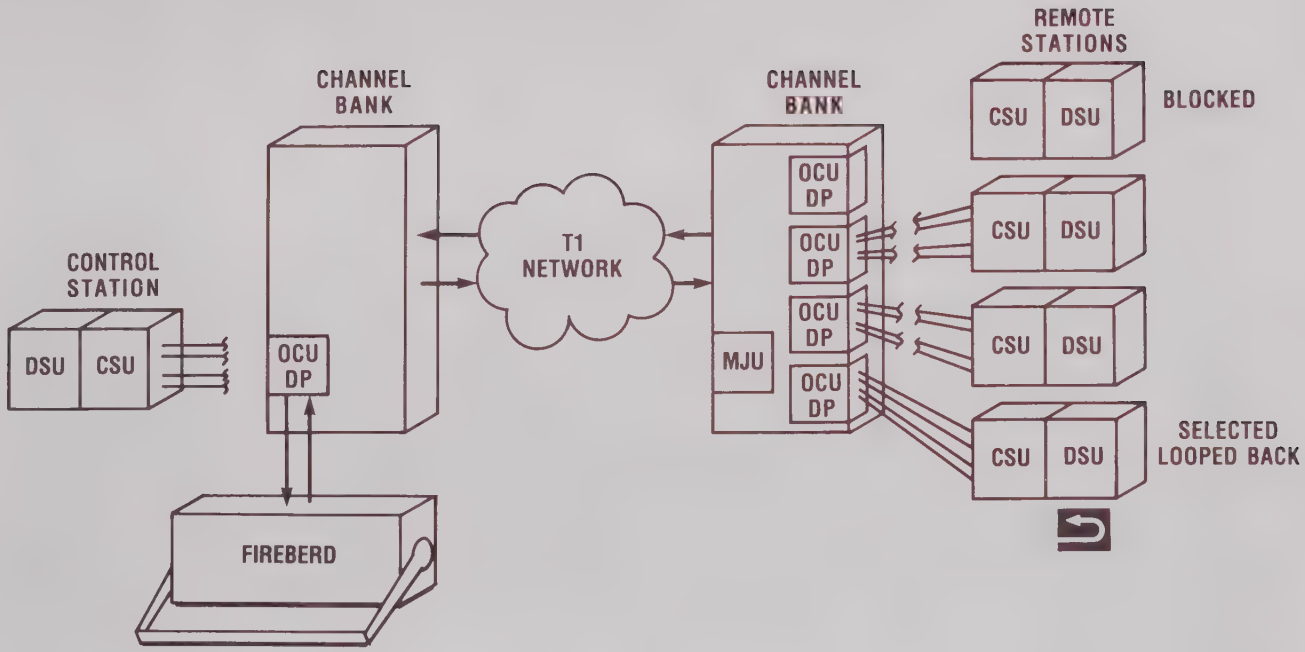


Figure 3-11
Far-End DSU Loopback

Basic Far-End DSU Loopback Test Set-Up

Here is a table which describes how the FIREBERD 6000 can be set up to perform a far-end DSU loopback test. Although these procedures apply specifically to 56 kb/s multipoint circuits, you can use them to set up a variety of loopback tests by selecting the appropriate equipment and loop types.

IMPORTANT: If your test fails to run after completing these set-up procedures, Section 3.5.5 offers additional information about DDS testing.

Table 3-8
Far-End DSU Loopback Test Set-Up

STEP:	ACTIVITY:
1.	With the power to the FIREBERD turned off, insert the DDS DS0A/B Interface in the designated rear-panel slot.
2.	Press the POWER switch to apply power to the FIREBERD 6000. **NOTE:** If the FIREBERD 6000 is in Self-Loop mode after power-up, disengage the SELF LOOP switch.
3.	Set the DATA switch to the 63, 511, or 2047 position.
4.	GEN CLK defaults to the INTF position.
5.	Using the MENU switch: a. Configure the DDS DS0A B interface using INTF SETUP. Select these soft keys: 1. DS0A B to select the DS0A B Interface. 2. MODE to select the data format. 3. DS0A to select the DS0A format. 4. RATE to scroll through the selections to 56. 5 ▲ ▲ INTFC to select the data coding. 6. LFAR to select far-end loop. 7. LOOP to access the loop selections. 8. ALT to access the alternating loop codes. 9. TYPE to scroll through the selections to DSU 10 ▲ ▲ ▬ AUX, MJU to access to MJU controls. 11. BRANCH to identify the desired branch (1-4) for the DSU loopback 12. SELECT to select the identified Branch. b. If a timed test is desired, do the following: 1. Set the MENU switch to TEST INTERVAL. 2. Press the MORE key twice, then press the TIMED soft key. 3. Set the desired test length using the MENU keypad, then press the ENTER key. 4. Set the ANALYSIS MODE switch (located to the right of the RESULTS area) to SINGLE

Legend
▲ Press the Up-Arrow key.
▬ Press the More key to access the next menu

Table 3-8
Far-End DSU Loopback Test Set-Up (Continued)

STEP:	ACTIVITY:
5. (continued)	If a continuous test is desired: 1. Set the MENU switch to TEST INTERVAL. 2. Set the desired measurement interval (default setting: 10^5), then press the ENTER key. 3. Set the ANALYSIS MODE switch (located to the right of the RESULTS area) to CONTINUOUS. c. If hard-copy test results are desired, set the print event criteria using PRINT EVENT, then enable the printer control block (located to the left of the POWER switch) by setting the OFF/ON switch to the ON position. **Sample Print Event Soft Key Sequence:** 1. NORMAL to specify standard test results. 2. TIME to access the time menu. 3. 15 (using MENU keypad and ENTER key) to obtain a results print every 15 minutes. 4. ▲ SYNLOS to access synchronization loss menu. 5. ON to print on synchronization loss. **RESULT:** The FIREBERD 6000 generates a printout every 15 minutes, and on the occurrence of a synchronization loss.
6.	Using the appropriate cables, connect the FIREBERD 6000 to the OCU-DP, and to the bit and byte clocks (see Section 3.5).
7.	Once the FIREBERD 6000 is configured properly and cabled to the circuit, the loop code sequence is initiated to establish a loopback by pressing the LOOP UP button on the bottom right corner of the front panel. The display will read "Transmitting loop code. Please wait . . ." **IMPORTANT:** After completing the test, press LOOP DOWN to remove the loopback and to return the isolated circuit path to normal operation. Return to the INTERFACE SETUP menu and release the MJU to normal operation by accessing the MJU controls under the AUX selections of the DDS DS0A/B Interface. Once into the MJU selections, press the MORE soft key and then the RELEAS soft key.
8.	Check that the SYNC LED located at the upper right-hand corner of the FIREBERD 6000 is illuminated. **RESULT:** The FIREBERD has achieved pattern synchronization, and is gathering test results. (Section 3.5.4 lists all DDS DS0A/B test results.)

3.5.3 Testing the Secondary Channel of a 9.6 kb/s Circuit—(Straightaway Test)

Figure 3-12 shows one FIREBERD 6000 equipped with a DDS DS0A/B Interface and one FIREBERD 6000 equipped with its internal RS-232 Interface. By performing a primary or secondary channel straightaway test between the channel bank and DSU, you can evaluate the performance of the OCU, the local loop, and the CSU/DSU.

Basic Straightaway Test Set-Up

Here is a table which describes how the FIREBERD 6000 with the DDS DS0A/B Interface can be set up to perform a straightaway test on the secondary channel of a 9.6 kb/s circuit. Refer to the relevant section for configuring the RS-232 Interface. Although these procedures apply specifically to 9.6 kb/s circuits with secondary channel, you can use them to set up any straightaway tests.

NOTE: This test requires two FIREBERDs, one with the DDS DS0A/B Interface and one with an RS-232 Interface.

IMPORTANT: If your test fails to run after completing these set-up procedures, Section 3.5.5 offers additional information about DS0 testing.

Table 3-9
Straightaway Test Set-Up

STEP:	ACTIVITY:
1.	With the power to the FIREBERD turned off, insert the DDS DS0A B Interface in the designated rear-panel slot.
2.	Press the POWER switch to apply power to the FIREBERD 6000. **NOTE:** If the FIREBERD 6000 is in Self-Loop mode after power-up, disengage the SELF LOOP switch.
3.	Set the DATA switch to the 511 or 2047 position.
4.	GEN CLK defaults to the INTF position.
5	Using the MENU switch: a. Configure the DDS DS0A/B Interface using INTF SETUP Select these soft keys: 1. DS0A/B to select the DS0A/B Interface. 2. MODE to select the data format. 3. DS0A to select the DS0A format. 4. RATE to scroll through the selections to 9.6. 5 ▲ ▲ INTFC to access the data coding. 6. LNEAR to select near local loop 7 ▲ ▲ MORE AUX to select the auxiliary functions. 8 MORE CHAN to select the secondary channel function 9. SEC to select the secondary channel for testing.

Legend
▲ Press the Up-Arrow key.
MORE Press the More key to access the next menu

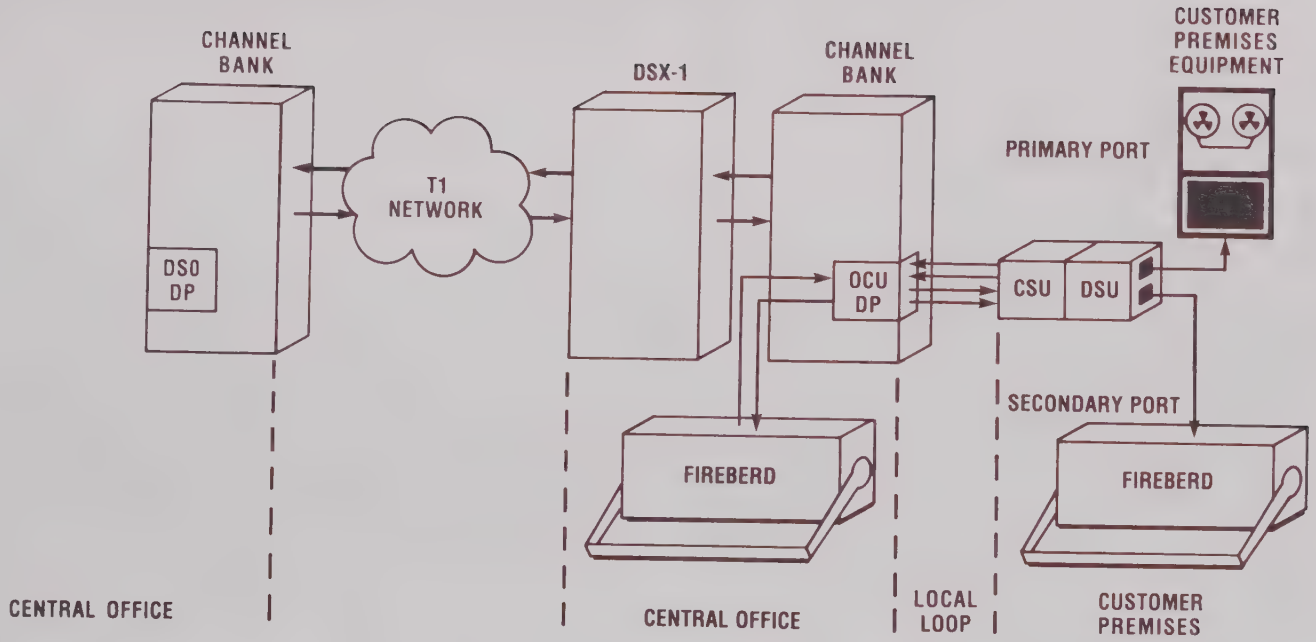


Figure 3-12
Secondary Channel Straightaway Test

Table 3-9
Near-End OCU Loopback Test Set-Up (Continued)

STEP:	ACTIVITY:
5. (continued)	**NOTE:** The FIREBERD is configured to test the secondary channel at this point. If another test device is connected to the protocol port, it can analyze the primary channel. b. If a timed test is desired, do the following: 1. Set the MENU switch to TEST INTERVAL. 2. Press the MORE key twice, then press the TIMED soft key. 3. Set the desired test length using the MENU keypad, then press the ENTER key. 4. Set the ANALYSIS MODE switch (located to the right of the RESULTS area) to SINGLE. If a continuous test is desired: 1. Set the MENU switch to TEST INTERVAL. 2. Set the desired measurement interval (default setting: 10^5), then press the ENTER key. 3. Set the ANALYSIS MODE switch (located to the right of the RESULTS area) to CONTINUOUS. c. If hard-copy test results are desired, set the print event criteria using PRINT EVENT, then enable the printer control block (located to the left of the POWER switch) by setting the OFF/ON switch to the ON position. **Sample Print Event Soft Key Sequence:** 1. NORMAL to specify standard test results. 2. TIME to access the time menu. 3. 15 (using MENU keypad and ENTER key) to obtain a results print every 15 minutes. 4. ▲ SYNLOS to access synchronization loss menu. 5. ON to print on synchronization loss. **RESULT:** The FIREBERD 6000 generates a printout every 15 minutes, and on the occurrence of a synchronization loss.
6.	1. Using the appropriate cables, connect the FIREBERD 6000 with the DDS DS0A/B Interface installed to the OCU, and to the bit and byte clocks (see Section 3.5). 2. Connect the other FIREBERD 6000 to the secondary channel port on the CPE side of the DSU.
7.	Check that the SYNC LED located at the upper right-hand corner of the FIREBERD 6000 is illuminated. **RESULT:** The FIREBERD has achieved pattern synchronization, and is gathering test results. (Section 3.5.4 lists all test results.)

3.5.4 DDS Test Results

Here are the significant test results that are available with all of the DDS applications described in this section. These results can be collected via printer or can be viewed at the ANALYSIS display window at the conclusion of any test.

Table 3-10
DDS Test Results

CATEGORY:	RESULTS:		
ERROR	BER AVG BLER AVG BER	BLOCKS CLK SLIP	BLK ERRS BIT ERRS
PERFORMANCE	ERR SEC DEG MIN %SES %AVL SEC	EFS %DEG MIN UNA SEC SYNL SEC	%EFS SES AVL SEC %SYN SEC
TIME	ERR EAS ELAP SEC	E A SEC TIME	E F EAS DATE
SIGNAL	DELAY RCV BYTE	RCV FREQ CTL CDS	GEN FREQ
T-CARRIER*	FRA ERR FRA LOSS	FE RATE	AVG FERR
ALARM	SYN LOSS	DAT LOSS	PWR LOSS

*Applicable only when receiving DS0B or DS0A at 19.2 kb/s.

Appendix B offers a glossary of all significant test results available with the FIREBERD 6000.

3.5.5 Notes on DDS Testing

If your test fails to run after completing the set-up procedures for your DDS application, the sections that follow may lead you to the solution. Note that only the most likely potential problem areas are addressed; if your test still fails to run after exploring these possibilities, call TTC's toll-free number (1-800-638-2049) for technical assistance.

Non-Availability of the Selected Timing Source

When the **GEN CLK** switch is illuminated or the "NO CLK" message is illuminated, it means that the FIREBERD 6000 cannot receive the clock from the selected timing source. In such instances, check your cables to ensure that the bit and byte clocks are properly connected.

Setting Auxiliary Functions

Sometimes the setting of one of the auxiliary functions may not be in agreement with the specifics of your application. Use Auxiliary Function 99 to reset all of your auxiliary functions to their default states.

CAUTION: The use of this function resets any auxiliary functions that were intentionally set when previously configuring the FIREBERD 6000.

Latching Loopbacks

Latching loopbacks have only recently been introduced into the Digital Data System. Many circuits do no respond to latching loop codes. When this occurs, use alternating loop codes.

3.6 T1 TESTING

Using the DS1/T1/D4/ESF/SLC-96 Interface (Model 40540) or the DS1/T1/D4/ESF Interface (Model 40460), the FIREBERD 6000 can test a variety of equipment operating at 1.544 Mb/s. These interfaces enable the FIREBERD 6000 to:

- Terminate a T1 line and supply a simplex current path.
- Transmit loop-up and loop-down codes to control loopbacks in compatible CSUs.
- Measure and generate jitter (when jitter options are installed).
- Analyze live traffic for bipolar violations, framing errors, or CRC errors.
- Receive and transmit data with or without D4, ESF, or SLC*-96 framing.
- Accept and generate either an AMI- or B8ZS-encoded signal.

3.6.1 Testing a 1.544 Mb/s Far-End CSU (Remote Loopback Testing)

Figure 3-13 shows a FIREBERD 6000 equipped with a DS1/T1 Interface. The instrument is terminating the near-end of the T1 network, and transmits data to and receives data from the far-end CSU. Using the DS1/T1 Interface, the FIREBERD sends a loop-up code to the far-end CSU; the far-end CSU goes into loopback toward the T1 network and the FIREBERD 6000. By analyzing the received data for errors, the FIREBERD analyzes the performance of the network up to and including the far-end CSU.

*Model 40540 only.

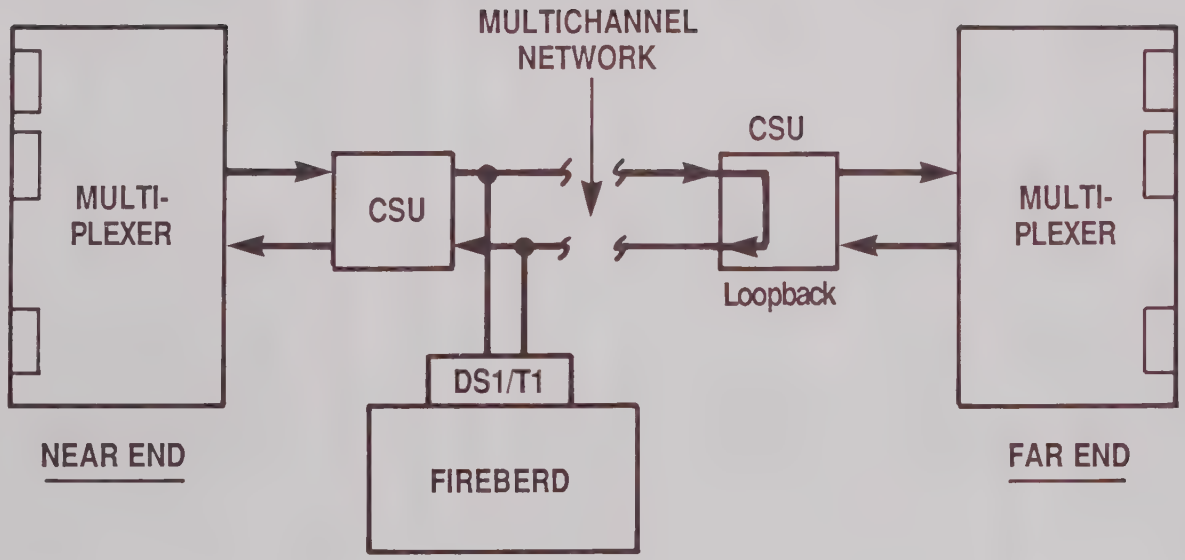


Figure 3-13
Testing a 1.544 Mb/s Far-End CSU in Loopback Mode

T1 Loopback Test Set-Up

Here is a table which describes how the FIREBERD 6000 can be set up to perform the 1.544 Mb/s T1 loopback test. Please note that these set-up procedures assume a network timing source, D4 framing, and AMI coding. Also remember that this is an out-of-service test that results in the removal of live data from the T1 line.

NOTE: This set-up procedure applies to both DS1/T1 interfaces, except where indicated by an asterisk.

IMPORTANT: If your test fails to run after completing these set-up procedures, Section 3.6.8 offers additional information about T1 testing.

Table 3-11
T1 Loopback Test Set-Up

STEP:	ACTIVITY:
1.	With the power to the FIREBERD turned off, insert the DS1/T1 Interface in the designated rear-panel slot.
2.	Press the POWER switch to apply power to the FIREBERD 6000. **NOTE:** If the FIREBERD 6000 is in Self-Loop mode after power-up, disengage the SELF LOOP switch.
3.	Set the DATA switch to the QRSS position. **NOTE:** QRSS is the standard test data pattern for T1 testing (see Section 2.2).
4.	Set the GEN CLK switch to SYNTH to select the network as a timing source (see Section 2.2).
5.	Using the MENU switch: a. Configure the DS1/T1 Interface using INTF SETUP. Select these soft keys: 1. DS1/T1 (or DS1/Fe) to select the DS1/T1 Interface. 2. RESULT to access the RESULT menu. 3. STD to select standard test results. 4. ▲ THRU to access the THRU menu. 5. OFF to select standard interface operation. 6. ▲ INPUT to access the INPUT menu. 7. TERM to select the 100-ohm line terminator. 8. ▲ MORE ERRINS* to access the ERRINS menu. 9. OFF to transmit without error insertion. 10. ▲ CODING to access CODING menu.

*BPVINS on Model 40460

Legend
▲ Press the Up-Arrow key
MORE Press the More key to access the next menu

Table 3-11
T1 Loopback Test Set-Up (Continued)

STEP:	ACTIVITY:
5. (continued)	11. AMI to select AMI coding. 12. ▲ FRAMED to access FRAMED menu. 13. D4 to select D4 framing. 14. ▲ MORE ▬ LBO to select LBO menu. 15. 0dB to select no line build-out. b. If a timed test is desired, do the following: 1. Set the MENU switch to TEST INTERVAL. 2. Press the MORE key twice, then press the TIMED soft key. 3. Set the desired test length using the MENU keypad, then press the ENTER key. 4. Set the ANALYSIS MODE switch (located to the right of the RESULTS area) to SINGLE. If a continuous test is desired: 1. Set the MENU switch to TEST INTERVAL. 2. Set the desired measurement interval (default setting: 10^5), then press the ENTER key. 3. Set the ANALYSIS MODE switch (located to the right of the RESULTS area) to CONTINUOUS. c. If hard-copy test results are desired, set the print event criteria using PRINT EVENT, then enable the printer control block (located to the left of the POWER switch) by setting the OFF/ON switch to the ON position. **Sample Print Event Soft Key Sequence:** 1. NORMAL to specify standard test results. 2. TIME to access the time menu. 3. 15 (using MENU keypad and ENTER key) to obtain a results print every 15 minutes. 4. ▲ SYNLOS to access synchronization loss menu. 5. ON to print on synchronization loss. **RESULT:** The FIREBERD 6000 generates a printout every 15 minutes, and on the occurrence of synchronization loss.
6.	Using the appropriate cables, connect the FIREBERD 6000 to the equipment under test.

Table 3-11
T1 Loopback Test Set-Up (Continued)

STEP:	ACTIVITY:
7.	Press the LOOP UP switch (located above the POWER switch) to send a loop code to the far-end CSU. **RESULT:** The message LOOP CODE TRANSMISSION SUCCESSFUL appears in the MENU display. Press the LOOP DOWN switch to return to normal operation at the conclusion of the test.
8.	Check that the SYNC LED located at the upper right-hand corner of the FIREBERD 6000 is illuminated. **RESULT:** The FIREBERD has achieved pattern synchronization, and is gathering test results. (Section 3.6.3 lists all CSU loopback and end-to-end test results for T1.)

3.6.2 End-To-End T1 Testing

Figure 3-14 shows two FIREBERD 6000s, each equipped with a DS1/T1 Interface. FIREBERD #1 connects to the 1.544 Mb/s near-end CSU; FIREBERD #2 connects to the far-end CSU. The instruments simultaneously generate test data and analyze the received data for errors in both directions. By analyzing the received data for errors, the FIREBERD measures the performance of the network in each direction.

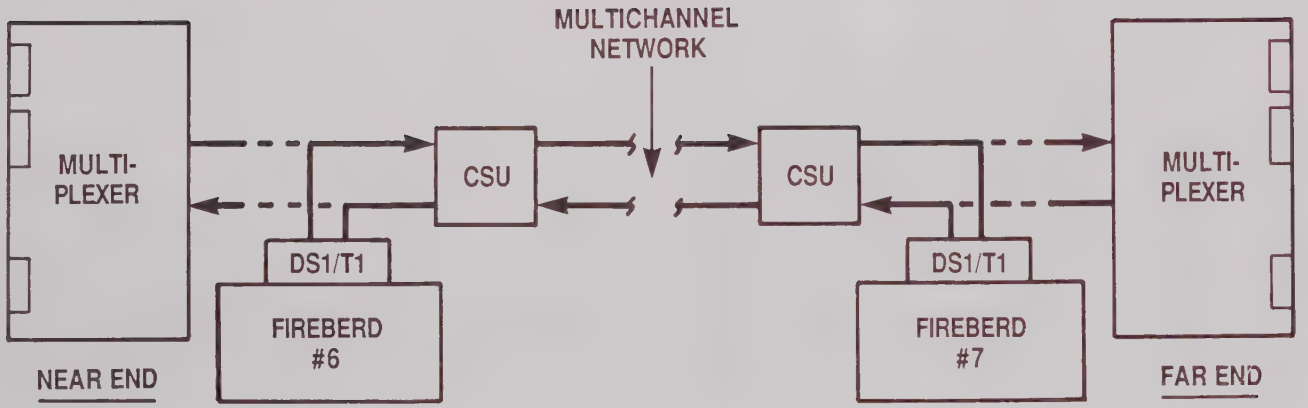


Figure 3-14
Simultaneous Testing of a Near-End and Far-End CSU

T1 End-to-End Test Set-Up

Here is a table which describes how the FIREBERD 6000 can be set up to perform the T1 end-to-end CSU test. Please note that these set-up procedures assume D4 framing and AMI coding. Also remember that this is an out-of-service test that results in the removal of live data from the T1 line.

NOTE: This set-up procedure applies to both DS1/T1 interfaces, except where indicated by an asterisk.

IMPORTANT: If your test fails to run after completing these set-up procedures, Section 3.6.8 offers additional information about T1 testing.

Table 3-12
T1 End-to-End Test Set-Up

STEP:	ACTIVITY:
1.	With the power to the FIREBERD turned off, insert the DS1/T1 Interface in the designated rear-panel slot.
2.	Press the POWER switch to apply power to the FIREBERD 6000. **NOTE:** If the FIREBERD 6000 is in Self-Loop mode after power-up, disengage the SELF LOOP switch.
3.	Set the DATA switch to the QRSS position. **NOTE:** QRSS is the standard test data pattern for T1 testing (see Section 2.2).
4.	Set the GEN CLK switch to INTF to select the network as a timing source. **NOTE:** Unless there is a source of network timing (e.g., DACS) in the circuit, only one FIREBERD 6000 can be set to INTF; the other must be set to SYNTH.
5.	Using the MENU switch: a. Configure the DS1/T1 Interface using INTF SETUP. Select these soft keys: 1. DS1/T1 (or DS1/Fe) to select the DS1/T1 Interface. 2. RESULT to access the RESULT menu. 3. STD to select standard test results. 4. ▲ THRU to access the THRU menu. 5. OFF to select standard interface operation. 6. ▲ INPUT to access the INPUT menu. 7. TERM to select the 100-ohm line terminator. 8. ▲ MORE ERRINS* to access the ERRINS menu. 9. OFF to transmit without error insertion.

*BPVINS on Model 40460

Legend
▲ Press the Up-Arrow key
MORE Press the More key to access the next menu

Table 3-12
T1 End-to-End Test Set-Up (Continued)

STEP:	ACTIVITY:
5. (continued)	10. ▲ CODING to access CODING menu. 11. AMI to select AMI coding. 12. ▲ FRAMED to access FRAMED menu. 13. D4 to select D4 framing. 14. ▲ MORE LBO to select LBO menu. 15. 0dB to select no line build-out. b. If a timed test is desired, do the following: 1. Set the MENU switch to TEST INTERVAL. 2. Press the MORE key twice, then press the TIMED soft key. 3. Set the desired test length using the MENU keypad, then press the ENTER key. 4. Set the ANALYSIS MODE switch (located to the right of the RESULTS area) to SINGLE. If a continuous test is desired: 1. Set the MENU switch to TEST INTERVAL. 2. Set the desired measurement interval (default setting: 10^5), then press the ENTER key. 3. Set the ANALYSIS MODE switch (located to the right of the RESULTS area) to CONTINUOUS. c. If hard-copy test results are desired, set the print event criteria using PRINT EVENT, then enable the printer control block (located to the left of the POWER switch) by setting the OFF/ON switch to the ON position. **Sample Print Event Soft Key Sequence:** 1. NORMAL to specify standard test results. 2. TIME to access the time menu. 3. 15 (using MENU keypad and ENTER key) to obtain a results print every 15 minutes. 4. SYNLOS to access synchronization loss menu. 5. ON to print on synchronization loss. **RESULT:** The FIREBERD 6000 generates a printout every 15 minutes, and on the occurrence of synchronization loss.
6.	Using the appropriate cables, connect the FIREBERD 6000 to the equipment under test.
7.	Check that the SYNC LED located at the upper right-hand corner of the FIREBERD 6000 is illuminated. **RESULT:** The FIREBERD has achieved pattern synchronization, and is gathering test results. (Section 3.6.3 lists all CSU loopback and end-to-end test results for T1.)

3.6.3 CSU Loopback and End-to-End Test Results

Here are the significant test results that are available when performing CSU loopback and end-to-end testing. These results can be collected via printer or can be viewed at the ANALYSIS display window at the conclusion of any test.

Table 3-13
CSU Loopback and End-to-End Test Results

CATEGORY:	RESULTS:		
ERROR	BER AVG BER	CLK SLIP	BIT ERRS
PERFORMANCE	ERR SEC DEG MIN %SES %AVL SEC	EFS %DEG MIN UNA SEC SYNL SEC	%EFS SES AVL SEC %SYN SEC
TIME	ERR EAS ELAP SEC	E A SEC TIME	E F EAS DATE
SIGNAL	DELAY	RCV FREQ	GEN FREQ
T-CARRIER	BPVs RCV CODE F E Rate	AVG BPVR FRA ERR FRA LOSS	BPV Rate AVG FER
ALARM	SYN LOSS XS0 SEC	SIG LOSS PWR LOSS	YEL SEC

Appendix B offers a glossary of all significant test results available with the FIREBERD 6000.

3.6.4 In-Service Monitoring

When equipped with a DS1/T1 Interface, the FIREBERD 6000 can monitor "live" T1 data.

Figure 3-15 depicts one-half of a typical multi-office inter/intra-LATA T1 circuit. The local loop consists of the portion of the circuit between the CSU at the customer site and the office repeater at the central office. Within the central office, the T1 signal passes through both a DACS and an M13 multiplexer to the long-haul facilities; the process is reversed at the far end of the link. In-service monitoring of T1 data with the FIREBERD 6000 can be performed at locations 1 through 5.

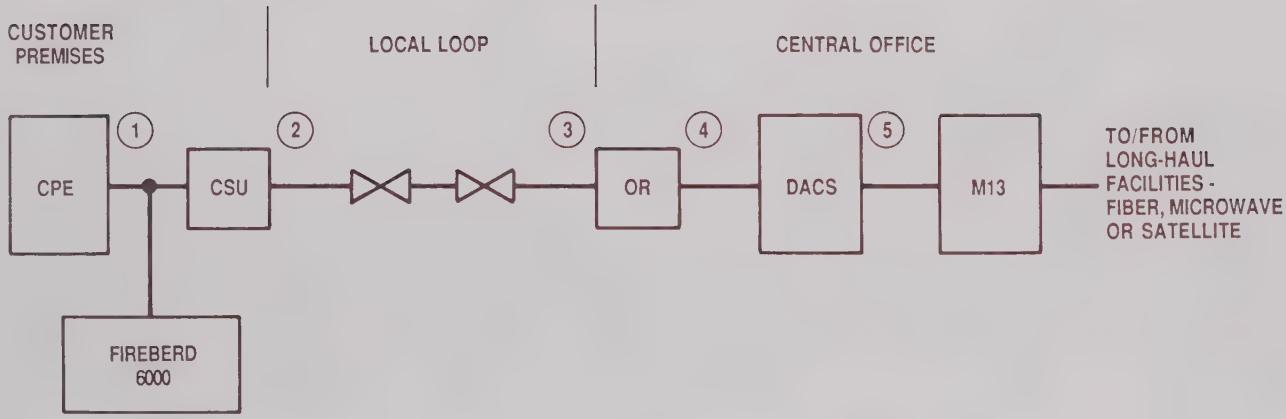


Figure 3-15
In-Service Monitoring

When performing in-service monitoring, the FIREBERD 6000 measures the following:

- T1 clock frequency
- Network Jitter (when jitter options are installed)
- Bipolar violations (BPVs)
- Excess zeroes
- CRC errors (where applicable)
- Frame errors
- Frame losses
- Performance standards
- "All ones" detection
- Yellow alarm

T1 Test Set Up—In-Service Monitoring

Here is a table which describes how the FIREBERD 6000 can be set up to perform in-service monitoring. Please note that these set-up procedures assume D4 framing and that such monitoring is being performed at a DSX patch bay.

NOTE: This set-up procedure applies to both DS1/T1 interfaces, except where indicated by an asterisk.

IMPORTANT: If your test fails to run after completing these set-up procedures, Section 3.6.8 offers additional information about T1 testing.

Table 3-14
In-Service Monitoring Set-Up

STEP:	ACTIVITY:
1.	With the power to the FIREBERD turned off, insert the DS1/T1 Interface in the designated rear-panel slot.
2.	Press the POWER switch to apply power to the FIREBERD 6000. **NOTE:** If the FIREBERD 6000 is in Self-Loop mode after power-up, disengage the SELF LOOP switch.
3.	Using the MENU switch: a. Configure the DS1/T1 Interface using INTF SETUP. Select these soft keys: 1. DS1/T1 (or DS1/Fe) to select the DS1/T1 Interface. 2. RESULT to access the RESULT menu. 3. LIVE to select live test results. 4. ▲ INPUT to access the INPUT menu. 5. DSXMON to receive signals from the DSX monitor. 6. ▲ More ERRINS* to access the ERRINS menu.

*BPVINS on Model 40460

Legend
▲ Press the Up-Arrow key
More Press the More key to access the next menu

Table 3-14
In-Service Monitoring Set-Up (Continued)

STEP:	ACTIVITY:
3. (continued)	7. OFF to transmit without error insertion. 8. ▲ FRAMED to access FRAMED menu. 9. D4 to select D4 framing. b. If a timed test is desired, do the following: 1. Set the MENU switch to TEST INTERVAL. 2. Press the MORE key twice, then press the TIMED soft key. 3. Set the desired test length using the MENU keypad, then press the ENTER key. 4. Set the ANALYSIS MODE switch (located to the right of the RESULTS area) to SINGLE. If a continuous test is desired: 1. Set the MENU switch to TEST INTERVAL. 2. Set the desired measurement interval (default setting: 10^5), then press the ENTER key. 3. Set the ANALYSIS MODE switch (located to the right of the RESULTS area) to CONTINUOUS. c. If hard-copy test results are desired, set the print event criteria using PRINT EVENT, then enable the printer control block (located to the left of the POWER switch) by setting the OFF/ON switch to the ON position. **Sample Print Event Soft Key Sequence:** 1. NORMAL to specify standard test results. 2. TIME to access the time menu. 3. 15 (using MENU keypad and ENTER key) to obtain a results print every 15 minutes. 4. ▲ SYNLOS to access synchronization loss menu. 5. ON to print on synchronization loss. **RESULT:** The FIREBERD 6000 generates a print out every 15 minutes, and on the occurrence of synchronization loss.
4.	Using the appropriate cables, connect the FIREBERD 6000's receiver to the DSX-MON jack at the DSX patch bay.
5.	Check that the SYNC LED located at the upper right-hand corner of the FIREBERD 6000 is illuminated. **RESULT:** The FIREBERD is monitoring live data. (Section 3.6.5 lists all in-service measurements for T1.)

3.6.5 In-Service Measurements

Here are the measurements that are available when performing in-service monitoring. These results assume that jitter measurement options are installed.

In-service measurements can be collected via printer or can be viewed at the ANALYSIS display window at the conclusion of any test.

NOTE: Bit errors are not measured when performing in-service monitoring.

Table 3-15
In-Service Monitoring Results

CATEGORY:	RESULTS:		
PERFORMANCE	DEG MIN %ACT SEC %SVS AVL SEC	%DEG MIN SVS %VFS %AVL SEC	SIGL SEC VFS UNA SEC
TIME	E A SEC DATE	ELAP SEC	TIME
SIGNAL	DELAY JTR HITS %MASK	MAX JTR RCV FREQ S/A	1SEC JTR GEN FREQ
T-CARRIER	BPVs V F EAS F E Rate	AVG BPVR % V F EAS FRA LOSS	BPV Rate RCV CODE FRA ERR
ALARM	SIG LOSS PWR LOSS	YEL SEC	XS0 SEC

Appendix B offers a glossary of all significant test results available with the FIREBERD 6000.

3.6.6 Measuring Network Jitter

When the FIREBERD 6000 is equipped with DS1 Wideband Jitter Measurement capability (Option 6001) and Spectral Analysis capability (Option 6002), it is possible to accurately measure network jitter. (The sticker on the rear of the FIREBERD 6000 indicates what options are installed in your unit.)

The Wideband Jitter Measurement option receives a jittered clock signal from the DS1/T1 interface; the option then demodulates the jittered clock, providing the following measurements:

- 1SEC JTR—Peak-to-peak jitter
- MAX JTR—Maximum peak-to-peak jitter
- JTR HITS—Jitter hits count

The Spectrum Analyzer option filters the received jitter and measures the maximum peak-to-peak jitter in a set of 40 frequency bands from 10 Hz to 40 kHz and displays the result in unit intervals (UI). The following measurements are available:

- S/A— Displays the discrete frequency band and the jitter amplitude measured by the spectrum analyzer.

- %MASK—Compares the measured jitter amplitude for each frequency band to the mask value for the same frequency. This result indicates whether the jitter amplitude is within the limits specified for a given mask; for example, 110% MASK is 10% above the allowable jitter level and 50% MASK is half the allowable jitter level. The FIREBERD 6000 offers masks that are fully compatible with CCITT Recommendation O.171 and Bell Technical Reference Publications PUB41451, PUB62411 (1983 and 1985), and PUB43801.

Network jitter can be measured using the out-of-service loopback or end-to-end tests described in Sections 3.6.1 and 3.6.2, and can also be measured simultaneously with standard in-service T1 testing. Results related to such testing are available in the SIGNAL category.

T1 Test Set-Up—Network Jitter Measurement

Here is a table which describes how the FIREBERD 6000 can be set up to measure network jitter. Please note that these set-up procedures

assume end-to-end testing, D4 framing, AMI coding, the installation of the spectrum analyzer, and the selection of the 62411-1983 jitter mask.

NOTE: This set-up procedure applies to both DS1/T1 interfaces, except where indicated by an asterisk.

IMPORTANT: If your test fails to run after completing these set-up procedures, Section 3.6.8 offers additional information about T1 testing.

Table 3-16
T1 Test Network Jitter Measurement Test Set-up

STEP:	ACTIVITY:
1.	With the power to the FIREBERD turned off, insert the DS1/T1 Interface in the designated rear-panel slot.
2.	Press the POWER switch to apply power to the FIREBERD 6000. **NOTE:** If the FIREBERD 6000 is in Self-Loop mode after power-up, disengage the SELF LOOP switch.
3.	Set the DATA switch to the QRSS position. **NOTE:** QRSS is the standard test data pattern for T1 testing (see Section 2.2).
4.	Set the GEN CLK switch to INTF to select the network as a timing source.
5.	a. Configure the DS1/T1 Interface using INTF SETUP. Select these soft keys: 1. DS1/T1 (or DS1/Fe) to select the DS1/T1 Interface. 2. RESULT to access the RESULT menu. 3. STD to select standard test results. 4. ▲ THRU to access the THRU menu. 5. OFF to select standard interface operation. 6. ▲ INPUT to access the INPUT menu. 7. TERM to select the 100-ohm line terminator. 8. ▲ MORE ERRINS* to access the ERRINS menu. 9. OFF to transmit without error insertion. 10. ▲ CODING to access CODING menu. 11. AMI to select AMI coding. 12. ▲ FRAMED to access FRAMED menu. 13. D4 to select D4 framing. 14. ▲ MORE LBO to select LBO menu. 15. 0dB to select no line build-out.

*BPVINS on Model 40460

Legend
▲ Press the Up-Arrow key
MORE Press the More key to access the next menu

Table 3-16
T1 Test Network Jitter Measurement Test Set-up (Continued)

STEP:	ACTIVITY:
5. (continued)	b. If a timed test is desired, do the following: 1. Set the MENU switch to TEST INTERVAL. 2. Press the MORE key twice, then press the TIMED softkey. 3. Set the desired test length using the MENU keypad, then press the ENTER key. 4. Set the ANALYSIS MODE switch (located to the right of the RESULTS area) to SINGLE. If a continuous test is desired: 1. Set the MENU switch to TEST INTERVAL. 2. Set the desired measurement interval (default setting 10^5), then press the ENTER key. 3. Set the ANALYSIS MODE switch (located to the right of the RESULTS area) to CONTINUOUS. c. Set the jitter criteria using the JITTER menu. Select these soft keys or keypad settings: 1. S/A to access the spectral analysis menu. 2. SWEEP to control the sweep function. 3. ON to select the sweep function. 4. ▲ ▲ HITS to define the jitter hit threshold. 5. HIT THR to 5.0 (using the MENU keypad). 6. ▲ MORE MASK to access the MASK menu. 7. 62411 to access the 62411 jitter mask menu. 8. ▲ ▲ MORE 1983 to select the 62411-1983 jitter mask. 9. FILTER to select how DS1 jitter bandwith is measured. 10. 8 kHz to select the 8 kHz highpass filter. d. If hard-copy test results are desired, set the print event criteria using PRINT EVENT, then enable the printer control block (located to the left of the POWER switch) by setting the OFF/ON switch to the ON position. <u>Sample Print Event Soft Key Sequence:</u> 1. NORMAL to specify standard test results. 2. ERROR to access error printout menu. 3. JITHIT to print when exceeding jitter hit threshold. 4. SYNLOS to access synchronization loss menu. 5. ON to print on synchronization loss. **RESULT:** The FIREBERD 6000 generates a printout when exceeding the jitter hit threshold and on the occurrence of synchronization loss.

Table 3-16
T1 Test Network Jitter Measurement Test Set-up (Continued)

STEP:	ACTIVITY:
6.	Using the appropriate cables, connect the FIREBERD 6000 to the equipment under test.
7.	Check that the SYNC LED located at the upper right-hand corner of the FIREBERD 6000 is illuminated. **RESULT:** The FIREBERD has achieved pattern synchronization, and is gathering test results. (Section 3.6.7 lists the test results that are available for network jitter measurement.)

3.6.7 Network Jitter Measurement Test Results

The test results that are available with the wideband jitter measurement and spectral analysis options appear in the SIGNAL results category. All other test results are identical to those listed in the previous T1 applications.

Network jitter measurement results can be collected via printer or can be viewed at the ANALYSIS RESULTS display at the conclusion of any test.

Table 3-17
Network Jitter Measurement Test Results

CATEGORY:	RESULTS:		
ERROR	BER AVG BER	CLK SLIP	BIT ERRS
PERFORMANCE	ERR SEC DEG MIN %SES %AVL SEC	EFS %DEG MIN UNA SEC SYNL SEC	%EFS SES AVL SEC %SYN SEC
TIME	ERR EAS ELAP SEC	E A SEC TIME	E F EAS DATE
SIGNAL	DELAY 1SEC JTR % MASK	RCV FREQ MAX JTR S/A	GEN FREQ JTR HITS
T-CARRIER	BPVs RCV CODE F E Rate	AVG BPVR FRA ERR FRA LOSS	BPV Rate AVG FER
ALARM	SYN LOSS XS0 SEC	SIG LOSS PWR LOSS	YEL SEC

Appendix B offers a glossary of all significant test results available with the FIREBERD 6000.

3.6.8 Notes on T1 Testing

If your test fails to run after completing the set-up procedures for your T1 application, the sections that follow may lead you to the solution. Note that only the most likely potential problem areas are addressed; if your test still fails to run after exploring these possibilities, call TTC's toll-free number (1-800-638-2049) for technical assistance.

Non-Availability of the Selected Timing Source

When setting the **GEN CLK** switch to the INTF position, it is important to be sure that a source of network timing exists for your specific application; the switch will illuminate when the FIREBERD cannot receive the clock from the selected timing source.

If your **GEN CLK** switch is illuminated, do the following:

1. Check your cables to make sure they are connected correctly.
2. If after checking your cables the **GEN CLK** switch is still illuminated, make sure that a network timing source (e.g., a DACS) exists for your application.
3. If a network timing source does not exist, use the FIREBERD 6000's frequency synthesizer as the timing source, as follows:
   a. Set the **GEN CLK** switch to the SYNTH position.
   b. Using the **MENU** switch, set the synthesizer frequency to 1544 using SYNTH FREQ and the appropriate soft key.

SUGGESTION: Even if the **GEN CLK** switch is not illuminated (and all seems functional), check the GEN FREQ measurement (under the SIGNAL analysis category) to ensure that your current generator clock frequency is the same as the T1 rate (1.544 Mb/s). This will confirm the presence and accuracy of a network clock source.

Incorrect Line Build-Out Value

Selecting the correct line build-out value for your test relates to how far the FIREBERD is from the nearest line or office repeater. If line build-out is set incorrectly, your FIREBERD may reflect a yellow alarm condition before your test even begins.

To ensure correct setting, check the line build-out value for the CSU that you are testing. If the setting differs from that specified for your test, change the line build-out value as follows:

1. Set the **MENU** switch to INTF SETUP.
2. Press the DS1/T1 soft key to access the DS1/T1 menu.
3. Press the MORE key twice to display the line build-out menu.
4. Set the line build-out to match the LBO value for the CSU you are testing.

Setting Auxiliary Functions

Sometimes the setting of one of the auxiliary functions may not be in agreement with the specifics of your application. Use Auxiliary Function 99 to reset all of your auxiliary functions to their default states.

CAUTION: The use of this function resets any auxiliary functions that were intentionally set when previously configuring the FIREBERD 6000.

3.7 G.703 TESTING

3.7.1 G.703 64 kb/s Testing

Figure 3-16 shows two FIREBERD 6000s, each equipped with a G.703 64 kb/s Interface. FIREBERD #1 connects to the 64 kb/s near-end Network Termination Equipment (NTE); FIREBERD #2 connects to the 64 kb/s far-end NTE. The instruments simultaneously generate test data and analyze the received data for bit errors in both directions. By analyzing the received data for errors, the FIREBERD simultaneously measures network performance in each direction. In this configuration, the FIREBERD can also measure network jitter (when the appropriate options are installed).

G.703 64 kb/s Test Set Up

Here is a table which describes how the FIREBERD 6000 can be set up to perform the previously described end-to-end 64 kb/s test. Please note that these set-up procedures assume codirectional timing mode.

IMPORTANT: If your test fails to run after completing these set-up procedures, Section 3.7.6 offers additional information about G.703 testing.

Table 3-18
G.703 64 kb/s Test Set-Up

STEP:	ACTIVITY:
1.	With the power to the FIREBERD turned off, insert the G.703 64 kb/s Interface in the designated rear-panel slot.
2.	Press the POWER switch to apply power to the FIREBERD 6000. **NOTE:** If the FIREBERD 6000 is in Self-Loop mode after power-up, disengage the SELF LOOP switch.

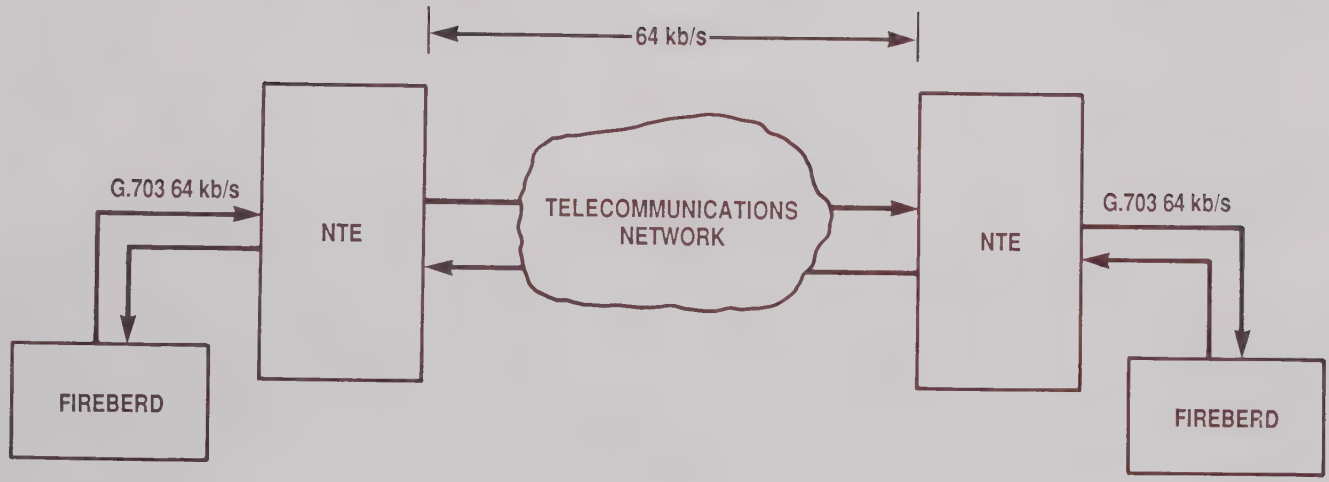


Figure 3-16
Simultaneous Testing of Near-End and Far-End LTUs
(G.703 64 kb/s Interface)

Table 3-18
G.703 64 kb/s Test Set-Up (Continued)

STEP:	ACTIVITY:
3.	Set the DATA switch to the 2^{15}-1 position.
4.	Set the GEN CLK switch to INTF to select the network as a timing source.
5.	a. Configure the G.703 64 kb/s Interface using INTF SETUP. Select these soft keys: 1. 64G703 to select the G.703 64 kb/s Interface. 2. MODE to access the INTF MODE menu. 3. CODIR to select codirectional timing mode. 4. ▲ THRU to access the THRU-DATA menu. 5. OFF to "turn off" the thru-data function. 6. ▲ ERRINS to access the ERROR INSERT menu. 7. OFF to transmit without error insertion. 8. ▲ MORE ▬ INPUT to access the INPUT IMPED menu. 9. TERM to select the 120-ohm line terminator. 10. ▲ OCTET to access the OCTET TIMING menu. 11. OFF to disable the 8 kHz octet timing signal. b. If a timed test is desired, do the following: 1. Set the MENU switch to TEST INTERVAL. 2. Press the MORE key twice, then press the TIMED soft key. 3. Set the desired test length using the MENU keypad, then press the ENTER key. 4. Set the ANALYSIS MODE switch (located to the right of the RESULTS area) to SINGLE. If a continuous test is desired: 1. Set the MENU switch to TEST INTERVAL. 2. Set the desired measurement interval (default setting: 10^5), then press the ENTER key. 3. Set the ANALYSIS MODE switch (located to the right of the RESULTS area) to CONTINUOUS. c. If hard-copy test results are desired, set the print event criteria using PRINT EVENT, then enable the printer control block (located to the left of the POWER switch) by setting the OFF/ON switch to the ON position. **Sample Print Event Soft Key Sequence** 1. NORMAL to specify standard test results. 2. TIME to access the time menu. 3. 15 (using MENU keypad and ENTER key) to obtain a results print every 15 minutes.

Legend
▲ Press the Up-Arrow key
▬ Press the More key to access the next menu

Table 3-18
G.703 64 kb/s Test Set-Up (Continued)

STEP:	ACTIVITY:
5. (continued)	4. ▲ SYNLOS to access synchronization loss menu. 5. ON to print on synchronization loss. **RESULT:** The FIREBERD 6000 generates a printout every 15 minutes, and on the occurrence of synchronization loss.
6.	Using the appropriate cables, connect the FIREBERD 6000 to the equipment under test.
7.	Check that the SYNC LED located at the upper right-hand corner of the FIREBERD 6000 is illuminated. **RESULT:** The FIREBERD has achieved pattern synchronization, and is gathering test results. (Section 3.7.2 lists all G.703 64 kb/s test results.)

3.7.2 G.703 64 kb/s Results

Here are the test results that are available with the previously described G.703 application. These results assume that G.703 jitter capability is not installed. When the G.703 jitter option is installed, the jitter-related test results are identical to those for T1.

G.703 64 kb/s test results can be collected via printer or can be viewed at the ANALYSIS display window at the conclusion of any test.

Table 3-19
G.703 64 kb/s Test Results

CATEGORY:	RESULTS:		
ERROR	BER AVG BER	BLK ERRS CLK SLIP	AVG BLER BIT ERRS
PERFORMANCE (G.821)	ERR SEC DEG MIN SES AVL SEC %SYN SEC	EFS %DEG MIN %SES %AVL SEC	%EFS SIGL SEC UNA SEC SYNL SEC
TIME	ERR EAS ELAP SEC	E A SEC TIME	E F EAS DATE
SIGNAL	DELAY	RCV FREQ	GEN FREQ
T-CARRIER	T-Carrier results are not applicable.		
ALARM	SYN LOSS	SIG LOSS	PWR LOSS

Appendix B offers a glossary of all significant test results available with the FIREBERD 6000.

3.7.3 G.704 2048 kb/s Testing

Figure 3-17 shows two FIREBERD 6000s, each equipped with a G.704 2048 kb/s Interface. FIREBERD #1 connects to the 2048 kb/s near-end NTE; FIREBERD #2 connects to the far-end NTE. The instruments simultaneously generate test data and analyze the received data for errors in both directions. By analyzing the received data for errors, the FIREBERDs measure the performance of the network in each direction.

G.704 2048 kb/s End-to-End Test Set-Up

Here is a table which describes how the FIREBERD 6000 can be set up to perform the previously described end-to-end 2048 kb/s test. Please note that these set-up procedures assume CRC4 multiframing, AMI coding, and recovered clock timing.

IMPORTANT: If your test fails to run after completing these set-up procedures, Section 3.7.6 offers additional information about G.703 testing.

Table 3-20
G.704 2048 kb/s End-to-End Test Set-Up

STEP:	ACTIVITY:
1.	With the power to the FIREBERD turned off, insert the G.704 2048 kb/s Interface in the designated rear-panel slot.
2.	Press the POWER switch to apply power to the FIREBERD 6000. **NOTE:** If the FIREBERD 6000 is in Self-Loop mode after power-up, disengage the SELF LOOP switch.
3.	Set the DATA switch to the 2^{15}-1 position.
4.	Set the GEN CLK switch to INTF to select the network as a timing source.
5.	Using the MENU switch: a. Configure the G.704 2048 kb/s Interface using INTF SETUP. Select these soft keys: 1. 2MG704 to select the G.704 2048 Interface. 2. FRAME to access the FRAME menu. 3. FRAME to specify multiframing 4. CRC4 to select CRC4 multiframing. 5. ▲ ▲ RESULT to access the RESULT menu. 6. STD to select out-of-service testing. 7. ▲ ERRINS to access the ERRINS menu. 8. OFF to transmit without error insertion. 9. ▲ MORE TLB to access the THRU LOOPBACK menu. 10. OFF to turn thru loopback off. 11. ▲ CODE to access CODE menu.

Legend
▲ Press the Up-Arrow key.
MORE Press the More key to access the next menu

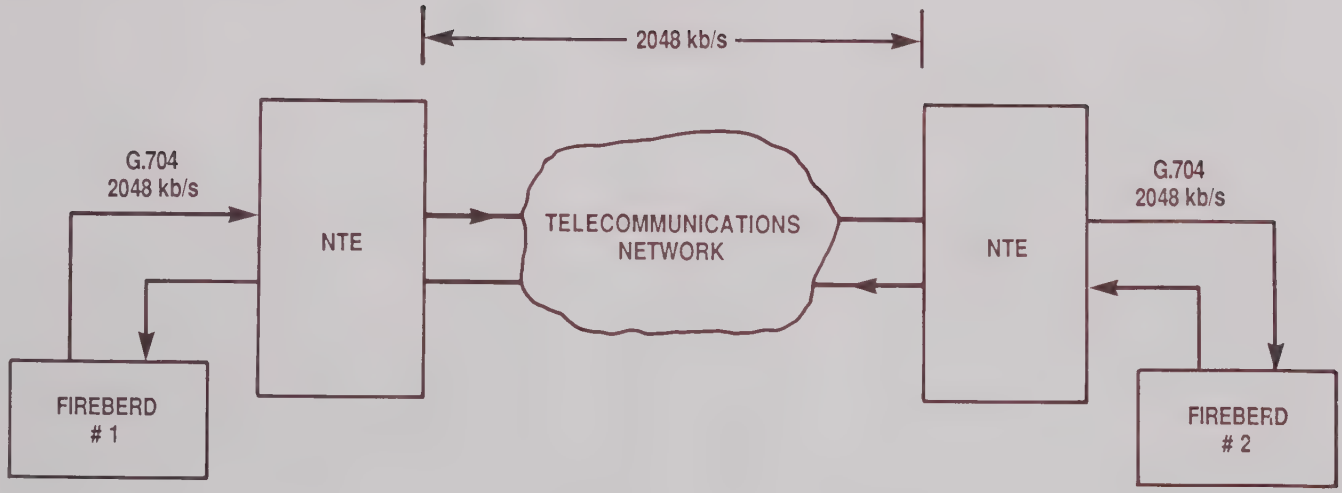


Figure 3-17
Simultaneous Testing of a Near-End and Far-End CSU

Table 3-20
G.704 2048 kb/s End-to-End Test Set-Up (Continued)

STEP:	ACTIVITY:
5. (continued)	12. AMI to select AMI coding. 13. ▲ CLOCK to access the CLOCK menu. 14. RECOV to select the recovered clock. 15. ▲ MORE LINE to select the LINE menu. 16. TERM to select the 120-ohm line terminator. b. If a timed test is desired, do the following: 1. Set the MENU switch to TEST INTERVAL. 2. Press the MORE key twice, then press the TIMED soft key. 3. Set the desired test length using the MENU keypad, then press the ENTER key. 4. Set the ANALYSIS MODE switch (located to the right of the RESULTS area) to SINGLE. If a continuous test is desired: 1. Set the MENU switch to TEST INTERVAL. 2. Set the desired measurement interval (default setting: 10^5), then press the ENTER key. 3. Set the ANALYSIS MODE switch (located to the right of the RESULTS area) to CONTINUOUS. c. If hard-copy test results are desired, set the print event criteria using PRINT EVENT, then enable the printer control block (located to the left of the POWER switch) by setting the OFF/ON switch to the ON position. **Sample Print Event Soft Key Sequence** 1. NORMAL to specify standard test results. 2. TIME to access the time menu. 3. 15 (using MENU keypad and ENTER key) to obtain a results print every 15 minutes. 4. ▲ SYNLOS to access synchronization loss menu. 5. ON to print on synchronization loss. **RESULT:** The FIREBERD 6000 generates a printout every 15 minutes, and on the occurrence of synchronization loss.
6.	Using the appropriate cables, connect the FIREBERD 6000 to the equipment under test.
7.	Check that the SYNC LED located at the upper right-hand corner of the FIREBERD 6000 is illuminated. **RESULT:** The FIREBERD has achieved pattern synchronization, and is gathering test results. (Section 3.7.4 lists all NTE loopback and end-to-end test results for 2048 kb/s.)

3.7.4 G.704 2048 kb/s Results

Here are the significant test results that are available with the previously described G.704 application. These results assume that jitter capability is not installed. When installed, the jitter related results are identical to those for T1.

G.704 results can be collected via printer or can be viewed at the ANALYSIS display window at the conclusion of any test.

Table 3-21
G.704 2048 kb/s Test Results

CATEGORY:	RESULTS:		
ERROR	BER AVG BER	CLK SLIP	BIT ERRS
PERFORMANCE	ERR SEC DEG MIN %SES %AVL SEC	EFS %DEG MIN UNA SEC SYNL SEC	%EFS SES AVL SEC %SYN SEC
TIME	ERR EAS ELAP SEC	E A SEC TIME	E F EAS DATE
SIGNAL	DELAY	RCV FREQ	GEN FREQ
T-CARRIER	BPVs FRA LOSS FW E Rate	AVG BPVR FW ERR	BPV Rate AVG FWER
ALARM	SYN LOSS AIS SEC	SIG LOSS PWR LOSS	YEL SEC

Appendix B offers a glossary of all significant test results available with the FIREBERD 6000.

3.7.5 Measuring Network Jitter (G.703)

When the FIREBERD 6000 is equipped with G.703 Wideband Jitter Measurement and Generation capability (Option 6007) and G.703 Spectral Analysis capability (Option 6008), it is possible to measure network jitter

on either a G.703 64 kb/s or 2048 kb/s digital stream. (The sticker on the rear of the FIREBERD 6000 indicates what options are installed in your unit.)

The Wideband Jitter Measurement option receives a jittered clock signal from either the G.703 64 kb/s interface or the G.704 2048 kb/s interface; the option then demodulates the jittered clock, providing the following measurements:

- 1SEC JTR—Peak-to-peak jitter
- MAX JTR—Maximum peak-to-peak jitter
- JTR HITS—Jitter hits count

The Spectrum Analyzer option filters the received jitter into a number of different frequency bands. If you are testing a 64 kb/s link, this option will measure the maximum peak-to-peak jitter in each of 37 discrete frequency bands from 10 Hz to 30 kHz. At 2048 kb/s, the option measures the maximum peak-to-peak jitter in 58 discrete frequency bands from 10 Hz to 100 kHz. The following measurements are available:

- S/A— Displays the discrete frequency band and a unit interval (UI) measurement of the jitter amplitude at that frequency.

- %MASK—Compares the measured jitter amplitude for each frequency band to the mask value for the same frequency. This result indicates whether the jitter amplitude is within the limits specified for a given mask; for example, 110% MASK is 10% above the allowable jitter level and 50% MASK is half the allowable jitter level. The FIREBERD 6000 offers masks that are fully compatible with CCITT Recommendation O.171, G.823, G.823N and the Dutch PTT's recommendation on the maximum allowable jitter on a 64 kb/s digital stream.

Network jitter can be measured using out-of-service loopback or end-to-end tests or during standard in-service monitoring of a 64 kb/s or 2048 kb/s digital network. Results related to such testing are available in the SIGNAL category, and are identical to those for T1.

G.703 64 kb/s Test Set Up—Network Jitter Measurement

Here is a table which describes how the FIREBERD 6000 can be set up to measure G.703 network jitter. Please note that these set-up procedures assume codirectional timing mode.

IMPORTANT: If your test fails to run after completing these set-up procedures, Section 3.7.6 offers additional information about G.703 testing.

Table 3-22
G.703 64 kb/s Network Jitter Measurement Test Set-Up

STEP:	ACTIVITY:
1.	With the power to the FIREBERD turned off, insert the G.703 64 kb/s Interface in the designated rear-panel slot.
2.	Press the POWER switch to apply power to the FIREBERD 6000. **NOTE:** If the FIREBERD 6000 is in Self-Loop mode after power-up, disengage the SELF LOOP switch.
3.	Set the DATA switch to the 2^{15}-1 position.
4.	Set the GEN CLK switch to INTF to select the network as a timing source.
5.	a. Configure the G.703 64 kb/s Interface using INTF SETUP. Select these soft keys: 1. 64G703 to select the G.703 Data Interface. 2. MODE to access the INTF MODE menu. 3. CODIR to select codirectional timing mode. 4. ▲ THRU to access the THRU-DATA menu. 5. OFF to "turn off" the thru-data function. 6. ▲ ERRINS to access the ERROR INSERT menu. 7. OFF to transmit without error insertion. 8. ▲ MORE INPUT to access the INPUT IMPED menu. 9. TERM to select the 120-ohm line terminator. 10. ▲ OCTET to access the OCTET TIMING menu. 11. OFF to disable the 8 kHz octet timing signal. b. If a timed test is desired, do the following: 1. Set the MENU switch to TEST INTERVAL. 2. Press the MORE key twice, then press the TIMED soft key. 3. Set the desired test length using the MENU keypad, then press the ENTER key. 4. Set the ANALYSIS MODE switch (located to the right of the RESULTS area) to SINGLE. If a continuous test is desired: 1. Set the MENU switch to TEST INTERVAL. 2. Set the desired measurement interval (default setting: 10^5), then press the ENTER key.

Legend
▲ Press the Up-Arrow key.
MORE Press the More key to access the next menu

Table 3-22
G.703 64 kb/s Network Jitter Measurement Test Set-Up (Continued)

STEP:	ACTIVITY:
5. (continued)	3. Set the ANALYSIS MODE switch (located to the right of the RESULTS area) to CONTINUOUS. c. Set the jitter criteria using the JITTER menu. Select these soft keys or keypad settings: 1. S/A to access the spectral analysis menu. 2. SWEEP to control the sweep function. 3. ON to measure jitter in each of the 37 discrete jitter frequency bands. 4. ▲ ▲ HITS to define the jitter hit threshold. 5. HIT THRESH set to 0.1 UI (using the menu keypad). 6. ▲ MORE MASK to access the jitter mask selection menu. 7. O.171 to select the CCITT O.171 jitter mask. 8. ▲ MORE RANGE to access the wideband analysis range selection menu. 9. BAND1 to measure 0.05 to 0.75 UI between 20 Hz and 5 kHz. d. If hard-copy test results are desired, set the print event criteria using PRINT EVENT, then enable the printer control block (located to the left of the POWER switch) by setting the OFF/ON switch to the ON position. **Sample Print Event Soft Key Sequence:** 1. NORMAL to specify standard test results. 2. ERROR to access error printout menu. 3. JITHIT to print when exceeding jitter hit threshold. 4. SYNLOS to access synchronization loss menu. 5. ON to print on synchronization loss. **RESULT:** The FIREBERD 6000 generates a printout when exceeding the jitter hit threshold and on the occurrence of synchronization loss.
6.	Using the appropriate cables, connect the FIREBERD 6000 to the equipment under test.
7.	Check that the SYNC LED located at the upper right-hand corner of the FIREBERD 6000 is illuminated. **RESULT:** The FIREBERD has acheived pattern synchronization, and is gathering test results.

G.704 2048 kb/s Test Set Up—Network Jitter Measurement

Here is a table which describes how the FIREBERD 6000 can be set up to measure G.703 network jitter.

IMPORTANT: If your test fails to run after completing these set-up procedures, Section 3.7.6 offers additional information about G.703 testing.

Table 3-23
G.704 2048 kb/s Network Jitter Measurement Test Set-Up

STEP:	ACTIVITY:
1.	With the power to the FIREBERD turned off, insert the G.704 2048 kb/s Interface in the designated rear-panel slot.
2.	Press the POWER switch to apply power to the FIREBERD 6000. **NOTE:** If the FIREBERD 6000 is in Self-Loop mode after power-up, disengage the SELF LOOP switch.
3.	Set the DATA switch to the 2^{15}-1 position.
4.	Set the GEN CLK switch to INTF to select the network as a timing source.
5.	Using the MENU switch: a. Configure the G.704 2048 kb/s Interface using INTF SETUP. Select these soft keys: 1. 2MG704 to select the G.704 2048 Interface. 2. FRAME to access the FRAME menu. 3. FRAME to specify multiframing. 4. CRC4 to select CRC4 multiframing. 5. ▲ ▲ RESULT to access the RESULT menu. 6. STD to select out-of-service testing. 7. ▲ ERRINS to access the ERRINS menu. 8. OFF to transmit without error insertion. 9. ▲ MORE ▬ TLB to access the THRU LOOPBACK menu. 10. OFF to turn thru loopback off. 11. ▲ CODE to access CODE menu. 12. AMI to select AMI coding. 13. ▲ CLOCK to access the CLOCK menu. 14. RECOV to select the recovered clock. 15. ▲ MORE ▬ LINE to select the menu. 16. TERM to select the 120-ohm line terminator. b. If a timed test is desired, do the following: 1. Set the MENU switch to TEST INTERVAL. 2. Press the MORE key twice, then press the TIMED soft key.

Legend

▲ Press the Up-Arrow key.

▬ Press the More key to access the next menu.

Table 3-23
G.704 2048 kb/s Network Jitter Measurement Test Set-Up (Continued)

STEP:	ACTIVITY:
5. (Continued)	3. Set the desired test length using the MENU keypad, then press the ENTER key. 4. Set the ANALYSIS MODE switch (located to the right of the RESULTS area) to SINGLE. If a continuous test is desired: 1. Set the MENU switch to TEST INTERVAL. 2. Set the desired measurement interval (default setting: 10^5), then press the ENTER key. 3. Set the ANALYSIS MODE switch (located to the right of the RESULTS area) to CONTINUOUS. c. Set the jitter criteria using the JITTER menu. Select these softkeys or keypad settings: 1. S/A to access the spectral analysis menu. 2. SWEEP to control the sweep function. 3. ON to measure jitter in each of the 58 discrete jitter frequency bands. 4. ▲ ▲ HITS to define the jitter hit threshold 5. HIT THRESH to 1.0 UI (using the menu keypad) 6. ▲ MORE MASK to access the jitter mask selection menu. 7. O.171 to select the CCITT O.171 jitter mask. 8. ▲ MORE RANGE to access the wideband analysis range selection menu. 9. BAND1 to measure 0.1 to 6.0 UI between 20 Hz and 27 kHz. d. If hard-copy test results are desired, set the print event criteria using PRINT EVENT, then enable the printer control block (located to the left of the POWER switch) by setting the OFF/ON switch to the ON position. **Sample Print Event Soft Key Sequence:** 1. NORMAL to specify standard test results. 2. ERROR to access error printout menu. 3. JITHIT to print when exceeding jitter hit threshold. 4. SYNLOS to access synchronization loss menu. 5. ON to print on synchronization loss. **RESULT:** The FIREBERD 6000 generates a printout when exceeding the jitter hit threshold and on the occurrence of a synchronization loss.

Table 3-23
G.704 2048 kb/s Network Jitter Measurement Test Set-Up (Continued)

STEP:	ACTIVITY:
6.	Using the appropriate cables, connect the FIREBERD 6000 to the equipment under test.
7.	Check that the SYNC LED located at the upper right-hand corner of the FIREBERD 6000 is illuminated. **RESULT:** The FIREBERD has achieved pattern synchronization, and is gathering test results.

3.7.6 Notes on G.703 Testing

If your test fails to run after completing the set-up procedures for your G.703 application, the sections that follow may lead you to the solution. Note that only the most likely potential problem areas are addressed.

Non-Availability of the Selected Timing Source

When setting the **GEN CLK** switch to the INTF position, it is important to be sure that a source of network timing exists for your specific application; the switch will illuminate when the FIREBERD cannot receive the clock from the selected timing source.

If your **GEN CLK** switch is illuminated, do the following:

1. Check your cables to make sure they are connected correctly.
2. If after checking your cables the **GEN CLK** switch is still illuminated, make sure that a network timing source (e.g., a DACS) exists for your application.
3. If a network timing source does not exist, use the FIREBERD 6000's frequency synthesizer as the timing source, as follows:
   a. Set the **GEN CLK** switch to the SYNTH position.
   b. Using the **MENU** switch, set the synthesizer frequency to 1544 using SYNTH FREQ and the appropriate soft key.

SUGGESTION: Even if the **GEN CLK** switch is not illuminated (and all seems functional), check the GEN FREQ measurement (under the SIGNAL analysis category) to ensure that your current generator clock frequency is the same as the T1 rate (1.544 Mb/s). This will confirm the presence and accuracy of a network clock source.

Setting Auxiliary Functions

Sometimes the setting of one of the auxiliary functions may not be in agreement with the specifics of your application. Use Auxiliary Function 99 to reset all of your auxiliary functions to their default states.

CAUTION: The use of this function resets any auxiliary functions that were intentionally set when previously configuring the FIREBERD 6000.

3.8 ISDN TESTING

3.8.1 Testing Voice and Data Simultaneously

Figure 3-18 depicts two FIREBERD 6000s (each equipped with an ISDN S/T Interface) establishing intra-switch communication. Emulating ISDN-compatible terminal equipment (TE), FIREBERD #1 places a voice call to FIREBERD #2, and FIREBERD #2 places a data call to FIREBERD #1. In this configuration, both instruments can test either B channel in voice or data mode and test the ability of the network to format, send, and receive D channel messages.

NOTE: FIREBERD #1 is placing the voice call and FIREBERD #2 is placing the data call for purposes of example only. In actual use, either FIREBERD can send or receive voice and data.

Basic ISDN Voice Call Set-Up

Table 3-24 describes the procedure for setting up an ISDN voice call like the one initiated by FIREBERD #1 in Figure 3-18. Note that these procedures assume that the B1 channel is carrying digitized voice that conforms to the μ PCM law.

IMPORTANT: If your test fails to run after completing these set-up procedures or if you desire additional information about ISDN testing, see Section 3.8.3.

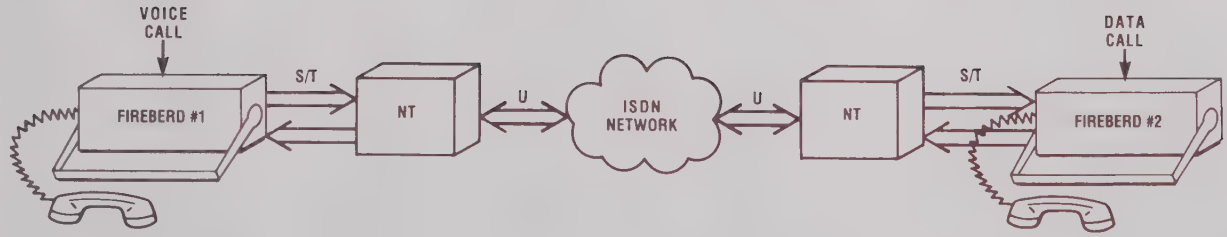


Figure 3-18
Simultaneous Testing of Voice and Data (ISDN Interface)

Table 3-24
ISDN Voice Call Test Set-Up

STEP	ACTIVITY:
1.	With the power to the FIREBERD turned off, insert the ISDN S/T Interface in the designated rear-panel slot.
2.	Insert the telephone handset plug into the connector marked HANDSET (located on the front panel of the ISDN interface).
3.	Press the POWER switch to apply power to the FIREBERD 6000. **NOTE**: If the FIREBERD 6000 is in Self-Loop mode after power-up, disengage the SELF LOOP switch.
4.	Set the MENU switch to the INTF SETUP position.
5.	Press the ISDN S softkey, then press the MORE key to bring SIGNAL and TERM into the MENU display.
6.	Press the SIGNAL softkey, then press the ACTIVE softkey to activate the transmitted signal.
7.	If the FIREBERD 6000 is the sole device on the S/T bus, press the TERM softkey twice (softkey number 2, then softkey number 1) to terminate the line. **NOTE**: If the S/T bus is serving more than one FIREBERD 6000, only the last instrument should be terminated.
8.	Plug the RJ 45 cord into the connector marked S/T BUS (located on the front of the ISDN interface). Insert the other end of the cord into the S/T connector. **Check These Test Results and Indicators**: 1. The TX INFO state has reached INFO 3and the RX INFO state has reached INFO 4 (SIGNAL category test result). 2. The FRM SYNC LED is illuminated. 3. The TEI is ASSIGNED (SIGNAL category test result). When all three have occurred, it means that the link between the FIREBERD and the NT has been successfully established.
9.	Set the MENU switch to INTF SETUP and configure the ISDN S/T interface using these soft keys:

Table 3-24
ISDN Voice Call Test Set-Up (Continued)

STEP:	ACTIVITY:
9. (Cont.)	1. ISDN S to choose the ISDN S/T Interface. When selected, GEN CLK is automatically set to INTF; TIMING MODE is automatically set to RECOVD. 2. VOICE to specify a voice call. 3. MORE TxCHAN to select a B channel. 4. ANY to automatically select the channel carrying voice. 5. ▲ LAW to select the appropriate PCM law. 6. μ-LAW to select μ PCM law. 7. ▲ MORE CALL to specify the telephone number of the called TE (FIREBERD #2). Use the MENU key-padto enter the number (18 characters maximum), then press the ENTER key. **NOTE**: To enter an asterisk (*) press the PERIOD (.) key; to enter a pound sign (#), press the SHIFT key followed by the PERIOD key. 8. DIAL to place the voice call to FIREBERD #2. **After Pressing the Dial Soft Key, Check the ANALYSIS RESULTS Display for These Messages**: • **Ringback** — indicates that the called FIREBERD 6000 is ringing. • **Call Connected** — indicates that your call has been answered by FIREBERD #2. (See Section 3.8.3 to learn how to answer a voice call.) A voice connection is now established. The handset can be used to talk to the user at the far end.

Legend
▲ Press the Up-Arrow key.
MORE Press the More key to access the next menu.

Basic ISDN Data Call Test Set-Up

Table 3-25 describes the procedure for setting up an ISDN data call like the one initiated by FIREBERD #2 in Figure 3-18. Note that these procedures assume that the B2 channel is carrying unrestricted data at the transmission rate of 64 kb/s.

IMPORTANT: If your test fails to run after completing these set-up procedures or if you desire additional information about ISDN testing, see Section 3.8.3.

Table 3-25
ISDN Data Call Test Set-Up

STEP	ACTIVITY:
1.	With the power to the FIREBERD turned off, insert the ISDN S/T Interface in the designated rear-panel slot.
2.	Insert the telephone handset plug into the connector marked HANDSET (located on the front panel of the ISDN interface).
3.	Press the POWER switch to apply power to the FIREBERD 6000. **NOTE**: If the FIREBERD 6000 is in Self-Loop mode after power-up, disengage the SELF LOOP switch.
4.	Set the MENU switch to the INTF SETUP position
5.	Press the ISDN S softkey, then press the MORE key to bring SIGNAL and TERM into the MENU display.
6.	Press the SIGNAL softkey, then press the ACTIVE softkey to activate the transmitted signal.
7.	If the FIREBERD 6000 is the sole device on the S/T bus, press the TERM softkey twice (softkey number 2, then softkey number 1) to select line termination. **NOTE**: If the S/T bus is serving more than one FIREBERD 6000, only the last instrument should be terminated.
8.	Plug the RJ 45 cord into the connector marked ST BUS (located on the front of the ISDN interface). Insert the other end of the cord into the ST connector. **Check These Test Results and Indicators**: 1. The TX INFO state has reached INFO 3 and the RX INFO state has reached INFO 4 (SIGNAL category test results). 2. The FRM SYNC LED is illuminated. 3. The TEI is ASSIGNED (SIGNAL category test result). When all three have occurred, it means that the link between the FIREBERD and the NT has been successfully established.

Table 3-25
ISDN Data Call Test Set-Up (Continued)

STEP	ACTIVITY:
9.	Using the MENU switch, do the following: a. If a timed test is desired: 1. Set the MENU switch to TEST INTERVAL. 2. Press the MORE key twice, then press the TIMED softkey. 3. Set the desired test length using the MENU keypad, then press the ENTER key. 4. Set the ANALYSIS MODE switch (located to the right of the RESULTS area) to SINGLE. If a continuous test is desired: 1. Set the MENU switch to TEST INTERVAL. 2. Set the desired measurement interval (default setting: 10^5), then press the ENTER key. 3. Set the ANALYSIS MODE switch (located to the right of the RESULTS area) to CONTINUOUS. b. If hard-copy test results are desired, set the (continued) print event criteria using PRINT EVENT, then enable the printer control block (located to the left of the POWER switch) by setting the OFF/ON switch to the ON position. **Sample Print Event Soft Key Sequence**: 1. NORMAL to specify standard test results. 2. TIME to access the time menu. 3. 60 (using MENU keypad and ENTER key) to obtain a results print every 60 minutes. 4. ▲ ERROR to access error printout menu. 5. MORE BITERR to print on the occurrence of bit errors. 6. ▲ SYNLOS to access synchronization loss menu. 7. ON to print on synchronization loss. **RESULT:** The FIREBERD 6000 generates a printout every 60 minutes, on the occurrence of bit errors, and during loss of synchronization. c. Configure the ISDN S/T interface using INTF SETUP. Select these softkeys: 1. ISDN S to choose the ISDN S/T Interface. When selected, GEN CLK is automatically set to INTF; TIMING MODE is automatically set to RECOVD. 2. DATA to specify a data call. 3. MORE TxRATE to select a transmission rate. 4. 64kbU to select unrestricted 64 kb/s transmission 5. ▲ TxCHAN to select a B channel. 6. ANY to automatically select the channel carrying data.

Table 3-25
ISDN Data Call Test Set-Up (Continued)

STEP	ACTIVITY:
	7. CALL to specify the telephone number of the called TE (FIREBERD #2). Use the MENU key-pad to enter the number (18 digits maximum), then press the ENTER key. **NOTE**: To enter an asterisk (*) press the PERIOD (.) key; to enter a pound sign (#), press the SHIFT key followed by the PERIOD key. 8. DIAL to place the data call to FIREBERD #1 and begin the test. **After Pressing the Dial Soft Key, Check the ANALYSIS RESULTS Display for These Messages**: • **Ringback** — indicates that the called FIREBERD 6000 is ringing. • **Call Connected** — indicates that your call has been answered by FIREBERD #1. (FIREBERD #1 must be in AUTO mode to answer your data call. See Section 3.8.3.) The connection between FIREBERDs is now established. Check test results as required.

3.8.2 ISDN Test Results

Table 3-25 shows the test results that are available with the ISDN interface. These results can be collected via printer or can be viewed at the ANALYSIS RESULTS display window at the conclusion of any test.

Table 3-26
ISDN Test Results

CATEGORY:	RESULTS:		
ERROR	BIT ERRS BLOCKS CLK SLIP	AVG BER BLK ERRS	BER AVG BLER
PERFORMANCE	ERR DEG MIN %SES %AVL SEC	SEC EFS %DEG MIN UNA SEC SYNL SEC	%EFS SES AVL SEC %SYN SEC
TIME	ERR EAS ELAP SEC	E A SEC TIME	E F EAS DATE
SIGNAL	RCV FREQ PWR STAT* TX INFO*	GEN FREQ R LVL-V* RX INFO*	DELAY R LVL-dB* TEI*
T-CARRIER	FRA LOSS** L2 ABORT*** FRMR***	L2 F ERR*** L2 FRMS***	FCS ERR*** REJ FRM***
ALARM	SYN LOSS V FR SEC***	SIG LOSS	PWR LOSS

Appendix B offers a glossary of all significant test results available with the FIREBERD 6000.

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*Not available in self-loop.
**Not available when the ISDN S/T TE Interface is deactivated.
***Both of the above.

3.8.3 Notes on ISDN Testing

This section offers some useful information on ISDN testing. If your test fails to run after completing the set-up procedures, you may find the solution here. Note that only the most likely potential problem areas are addressed; if your test still fails to run after exploring these possibilities, call TTC's toll-free number (1-800-638-2049) for technical assistance.

TEI Not Assigned

If **TEI NOT ASSN** appears in the ANALYSIS RESULTS display, it may indicate a problem in the connection between the NT and the switch. Still another possibility is that the transmitted signal is deactivated; check the interface's SIGNAL menu to determine if ACTIVE is the current selection.

Channel In Use By TE

When the message **B Channel in Use by this TE** appears in the display, it means that a call is already in progress on the channel that you have selected; return to the appropriate TXCHAN menu (VOICE or DATA) and choose ANY.

Error Messages

When connection to the called TE cannot be established, the FIREBERD 6000 displays an error message indicating the likely cause. The message appears in the ANALYSIS RESULTS display, and can sometimes be helpful in determining appropriate action. The *ISDN S/T TE Interface Operating Manual* provides a list of all error messages and their associated cause numbers.

Called FIREBERD Not Connected

If the message **No User Responding** is displayed as a cause for a connection failure, it's possible that the called FIREBERD 6000 is simply not connected or is powered off. In such instances, make sure that the operator of the called instrument has successfully completed steps 1-4 of the appropriate test set-up procedure.

Answering a Voice or Data Call

When a FIREBERD 6000 receives a voice call, the called instrument simulates a bell tone and displays a **Ringing** message in the ANALYSIS RESULTS display. To answer a voice call, press the ANSWER soft key under the VOICE menu; when pressed, the message **Call Connected** appears in the ANALYSIS RESULTS display.

The FIREBERD 6000 has the ability to answer data calls automatically. To make sure the AUTO ANSWER feature is implemented, press the ANSWER soft key under the DATA menu; if AUTO is not currently selected, press the AUTO key. When IGNORE is selected, incoming data calls are rejected and the FIREBERD 6000 flashes the message **Data Call Ignored** in the ANALYSIS RESULTS display.

3.9 T1/FT1 TESTING

3.9.1 Testing Fractional T1 End-To-End

Figure 3-19 shows two FIREBERD 6000s, each equipped with a T1/FT1 interface. Using these two FIREBERDs, it is possible to evaluate the performance of a Fractional T1 circuit end-to-end. Both sides of the circuit are tested with a pattern that is transmitted from both ends of the span.

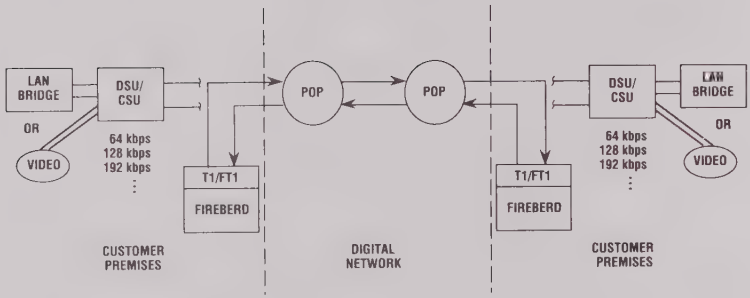

Figure 3-19
End-To-End Fractional T1 Testing

Fractional T1 Test Set-Up

Here is a table which describes how the FIREBERD 6000 can be set up to perform an end-to-end fractional T1 test. The procedure in this table verifies the performance of a 384 (6 x 64 kb/s) fractional T1 circuit where channels 1 - 6 are used for data transmission.

NOTE: Perform all steps for the FIREBERD at each test location.

Table 3-27
End-To-End Fractional T1 Testing

STEP	ACTIVITY
1.	With the power to the FIREBERD 6000 turned off, insert the T1/FT1 Interface in the rear-panel interface slot.
2.	Press the POWER switch to apply power to the FIREBERD 6000. **NOTE:** If the FIREBERD 6000 is in Self-Loop mode after power-up, disengage the SELF LOOP switch.
3.	Select a test data pattern using the DATA switch. (Example: QRSS.)
4.	Set the GEN CLK switch to the INTF position to derive the transmit clock from the network.
5.	Using the MENU switch: a. Configure the T1/FT1 Interface using INTF SETUP. Select these softkeys: 1. T1/FT1 to select the T1/FT1 Interface. 2. CONFIG to access the configuration menu. 3. FRAME to select framing. (Example: ESF.) 4. CODE to select coding. (Example: B8ZS.) 5. INPUT to TERM. 6. ▲ MODE to access the mode menu. 7. FRACT1 for fractional T1 testing. 8. Scroll through each T1 channel (1 - 24) using the CHAN# softkey. Press the RX and TX softkeys to select channels 1 - 6. Press the MORE key and select the channel data rate Nx64. 9. ▲ ▲ ERRINS to access the error insert menu. 10. OFF to turn the error insert off. 11. Press the UP ARROW to access the main menu. 12. ▲ MORE IDLE to select the idle code. Select the idle code using the left and right cursor keys and the 1 and 0 keys on the keypad. Press the ENTER key to save the changes. Common idle codes: 0111 1111 or 1111 1111.

3.9.2 Installing and Troubleshooting Customer Premise Equipment

Figure 3-20 depicts two FIREBERD 6000s accessing both the DTE and T1 network side of the Fractional T1 DSU/CSU. FIREBERD #1 is equipped with a V.35 Data Interface and FIREBERD #2 is equipped with a

T1/FT1 Interface. By access both sides of the Customer Premise Equipment (CPE), the FIREBERD can test for proper T1 timing and signal using slips, level, frequency, and jitter measurement while performing BERT Analysis on the designated bandwidth.

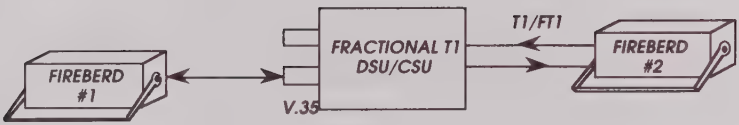

Figure 3-20
Installing and Troubleshooting Customer Premise Equipment

CPE Test Set-Up

Here is a table which describes how the FIREBERD 6000 can be set up to perform a test of CPE equipment. The procedure in this table permit a the testing of a fractional T1 DSU/CSU as stand-alone equipment. In this application, 256 kb/s (4 x 64 kb/s) bit error analysis is performed on 4 non-contiguous channels.

Table 3-28 describes the set-up procedures for FIREBERD #1; Table 3-29 describes the set-up procedures for FIREBERD #2.

Table 3-28
CPE Test Set-Up (FIREBERD #1)

STEP	ACTIVITY
1.	With the power to the FIREBERD 6000 turned off, insert the V.35 Interface in the rear-panel interface slot.
2.	Press the POWER switch to apply power to the FIREBERD 6000. **NOTE:** If the FIREBERD 6000 is in Self-Loop mode after power-up, disengage the SELF LOOP switch.
3.	Select a test data pattern using the DATA switch. Example QRSS.
4.	Set the GEN CLK switch to the INTF position to receive the clock from the DCE.
5.	Since the V.35 Data Interface is not controllable via the FIREBERD 6000 front panel, configure the V.35 Data Interface using the switches on the interface as follows: a. TRANSMIT CLOCK INVERT switch to NORMAL. b. RECEIVE CLOCK INVERT switch to NORMAL. c. TIMING MODE switch to 306.
6.	Illuminate the RTS and DTR switches located just above the POWER switch to set both signaling leads HIGH.
7.	Set the MENU switch to SYNTH FREQ and set the synthesizer frequency to 256 kbps.

Table 4-2 describes the set-up procedures for FIREBERD #1.

Table 3-29
CPE Test Set-Up (FIREBERD #2)

STEP	ACTIVITY
1.	With the power to the FIREBERD 6000 turned off, insert the T1/FT1 Interface in the rear-panel interface slot.
2.	Press the POWER switch to apply power to the FIREBERD 6000. **NOTE:** If the FIREBERD 6000 is in Self-Loop mode after power-up, disengage the SELF LOOP switch.

Table 3-29
CPE Test Set-Up (FIREBERD #2) (continued)

STEP	ACTIVITY
3.	Select a test data pattern using the DATA switch. Example QRSS.
4.	Set the GEN CLK switch to the INTF position to derive the transmit clock from the DCE.
5.	Using the MENU switch: a. Configure the T1/FT1 Interface using the INTF SETUP. Make these softkey selections: 1. T1/FT1 to select the T1/FT1 Interface. 2. CONFIG to access the configuration menu. 3. FRAME to select framing. (Example ESF.) 4. CODE to select coding. (Example AMI.) 5. INPUT as required (TERM, BRIDGE, or DSXMON). 6. ▲ MODE to access the mode menu. 7. FRACT1 for Fractional T1 testing. 8. Scroll through the channels using the CHAN# softkey. Press the RX and TX softkeys to select channels 1, 3, 5, and 7. Press the MORE key and select the channel data rate Nx64. 9. ▲ ▲ ERRINS to access the error insert menu. 10. Off to turn the error insert off. 11. ▲ MORE IDLE to set the code. Set the idle code using the left and right cursor keys and the 1 and 0 keys on the keypad. Press the ENTER key to save the changes.

3.9.3 T1/FT1 Test Results

Here are the test results that are available when using the DS1/T1 Interface.

Table 3-30
T1/FT1 Test Results

CATEGORY	RESULTS			
ERROR	AVG BER	BER	BIT ERRS	PAT SLIP
PERFORM-ANCE	%AVL SEC AVL SEC ERR-SES GERR SEC	%DEG MIN BER-SES G %EFS SES	%SES DEG MIN G EFS UNA SEC	

Table 3-30
T1/FT1 Test Results (continued)

CATEGORY	RESULTS			
TIME	%PAT SEC	DATE	EA SEC	
	EF EAS	ELAP SEC	ERR EAS	
	PATL SEC	TIME		
T-CARRIER	%VF EAS	AVG BPVR	AVG CRC	
	AVG FER	BIT SLIP	BPVs	
	BPV Rate	CRC ERR	CRC E Rt	
	FE Rate	FRA ERR	FRA LOSS	
	MAX ZERO	RCV BOM	Rx ABCD	
	VF EAS			
SIGNAL	% MASK	+LVL V	-LVL V	
	+LVL dB	-LVL dB	+WNDR	PP WNDR
	-WNDR	1SEC JTR	15m WNDR	
	24 WNDR	B8ZS DETECTED	DELAY	
	GEN FREQ	JTR HITS	LVL dBm	
	MAX JTR	PP LVL V	RCV BYTE	
ALARMS	1s DEN S	AIS SEC	PAT LOSS	
	PWR LOSS	SIG LOSS	XSO SEC	
	YEL SEC			

Appendix B offers a glossary of all significant test results available with the FIREBERD 6000.

3.10 RS-449/530/MIL TESTING

3.10.1 Synchronous Testing — Analyzing The Near-End Modem (Local Loopback) Or the Far-End Modem (Remote Loopback)

Figure 3-21 shows a FIREBERD 6000 equipped with an RS-449/530/MIL Interface. The instrument is connected to a near-end 9600 b/s modem (MODEM #1) and a far-end 9600 b/s modem (MODEM #2). By looping either modem output back to its own input the FIREBERD can transmit test data to either the near-end modem or the far-end modem and analyze the "looped-back" data for errors.

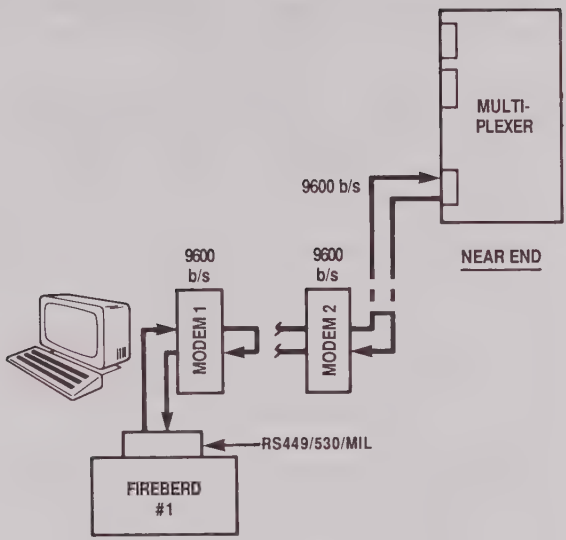

Figure 3-21
Near-End and Far-End Loopback Testing

RS-449/530/MIL Synchronous Test Set-Up

Here is a table which describes how the FIREBERD 6000 can be set up to perform the synchronous test described in this section. Although these procedures specifically apply to the testing of modems and multiplexers that use the EIA-530 connector, you can employ them to set up any basic synchronous test using the RS-449/530/MIL Interface.

Table 3-31
EIA-530 Synchronous Test Set-Up

STEP	ACTIVITY
1.	With the power to the FIREBERD 6000 turned off, insert the RS-449/530/MIL Data Interface in the rear-panel interface slot.
2.	Press the POWER switch to apply power to the FIREBERD 6000. **NOTE:** If the FIREBERD 6000 is in Self-Loop mode after power-up, disengage the SELF LOOP switch.

Table 3-31
EIA-530 Synchronous Test Set-Up (continued)

STEP	ACTIVITY
3.	Set the DATA switch to either the 511 or 2047 data pattern when transmitting test data to either the near-end or far-end modem. When testing a 64 kb/s subrate channel, select either the 2047 or 2^{15}-1 data pattern. **NOTE:** These pattern settings are recommended rather than required.
4.	Set the GEN CLK switch to the INTF position to receive the clock from the DCE.
5.	Set the TIMING switch to the SYNC position.
6.	Using the MENU switch: a. Configure the RS-449/530/MIL Data Interface using INTF SETUP. Select these softkeys: 1. MIL449 to select the RS-449/530/MIL Data Interface. 2. EIA530 to select the type of interface. 3. EMULATE to select DTE emulation. 4. SIGnaling to POSitive. 5. LL (Local Loop) and RL (Remote Loopback) ON or OFF based on test requirements. 6. ▲ MODE to select the mode menu. 7. BAL for balanced mode. 8. IMPEDANCE as required (78, 100, 124, or UNTERM).
7.	If a timed test is desired: 1. Set the MENU switch to TEST INTERVAL. 2. Press the MORE key twice, then press the TIMED softkey. 3. Set the desired test length using the MENU keypad, then press the ENTER key. 4. Set the ANALYSIS MODE switch (located to the right of the RESULTS area) to SINGLE.
8.	If a continuous test is desired: 1. Set the MENU switch to TEST INTERVAL. 2. Set the desired measurement interval (default setting: 10^5), then press the ENTER key. 3. Set the ANALYSIS MODE switch (located to the right of the RESULTS area) to CONTINUOUS.
9.	If hard-copy test results are desired, set the print event criteria using the PRINT EVENT category of the MENU switch, then set the

Table 3-31
EIA-530 Synchronous Test Set-Up (continued)

STEP	ACTIVITY
9. (cont.)	printer control block (to the left of the POWER switch) by setting the OFF/ON switch to the ON position.
10.	Using the appropriate cables, connect the FIREBERD 6000 to the equipment under test.
11.	Illuminate the RTS and DTR switches to set both signaling leads to HIGH.
12.	Check that the SYNC LED located at the upper right corner of the FIREBERD 6000 is illuminated. **RESULT:** The FIREBERD has achieved pattern synchronization and is gathering test results.

3.10.2 RS-449/530/MIL Synchronous Test Results

Here are the synchronous test results that are available when using the RS-449/530/MIL interface.

Table 3-32
RS-449/530/MIL Test Results

CATEGORY	RESULTS		
ERROR	AVG BER BER PAT SLIP	BER BLOCKS	BIT ERRS BLK ERRS
PERFORMANCE	%AVL SEC AVL SEC ERR-SES GERR SEC	%DEG MIN BER-SES G %EFS SES	%SES DEG MIN G EFS UNA SEC
TIME	ERR EAS ELAP SEC	EA SEC TIME	EF SEC DATE
T-CARRIER	NO T-CARRIER RESULTS RETURNED		
SIGNAL	DELAY	RCV FREQ	GEN FREQ

Table 3-32
RS-449/530/MIL Test Results (continued)

CATEGORY	RESULTS		
ALARMS	PAT LOSS C-D CHA	DAT LOSS PWR LOSS	CLK LOSS

Appendix B offers a glossary of all significant test results available with the FIREBERD 6000.

3.10.3 Asynchronous Testing — Testing a 1200 b/s Asynchronous Modem (Local Loopback)

Figure 3-22 shows a FIREBERD 6000 equipped with an RS-449/530/MIL Interface. The instrument is connected to a 1200 b/s modem operating in accordance with MIL-STD-188C Interface specifications. The modem has its output looped back to its own input. The FIREBERD both transmits the test data and analyzes the received data for errors.

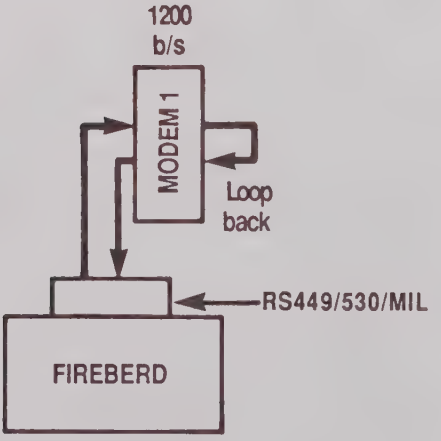

Figure 3-22
Testing an Asynchronous Modem

RS-449/530/MIL Asynchronous Test Set-Up

Here is a table which describes how the FIREBERD 6000 can be set up to perform the asynchronous test described in this section. Although it specifically applies to MIL-STD-188-C circuits and equipment, it can be generally used to set up any asynchronous test.

Table 3-33
MIL-STD-188-C Asynchronous Test Set-Up

STEP	ACTIVITY
1.	With the power to the FIREBERD 6000 turned off, insert the RS-449/530/MIL Data Interface in the rear-panel interface slot.
2.	Press the POWER switch to apply power to the FIREBERD 6000. **NOTE:** If the FIREBERD 6000 is in Self-Loop mode after power-up, disengage the SELF LOOP switch.
3.	Set the DATA switch to the FOX position. **NOTE:** This pattern setting is recommended rather than required.
4.	Set the GEN CLK switch to the SYNTH position to receive the clock from the DCE.
5.	Set the TIMING switch to the ASYNC position.
6.	Set the MENU switch to the SYNTH FREQ position. Set the synthesizer frequency to the desired rate.
7.	Using the MENU switch: a. Configure the RS-449/530/MIL Data Interface using INTF SETUP. Select these softkeys: 1. MIL449 to select the RS-449/530/MIL Data Interface. 2. MORE 188C to specify the type of interface. 3. EMULATE to select DTE emulation. 4. SIGnaling to POSitive. 5. LL (Local Loop) and RL (Remote Loopback) ON or OFF based on test requirements. 6. ▲ MODE to select the mode menu. 7. BAL for balanced mode. 8. IMPEDANCE as required (78, 100, 124, or UNTERM).
8.	Set the MENU switch to the CHAR FORMAT position. Select the desired DATA, PARITY, and STOP bits.

Table 3-33
MIL-STD-188-C Asynchronous Test Set-Up (continued)

STEP	ACTIVITY
9.	If a timed test is desired: 1. Set the MENU switch to TEST INTERVAL. 2. Press the MORE key twice, then press the TIMED softkey. 3. Set the desired test length using the MENU keypad, then press the ENTER key. 4. Set the ANALYSIS MODE switch (located to the right of the RESULTS area) to SINGLE.
10.	If a continuous test is desired: 1. Set the MENU switch to TEST INTERVAL. 2. Set the desired measurement interval (default setting: 10^5), then press the ENTER key. 3. Set the ANALYSIS MODE switch (located to the right of the RESULTS area) to CONTINUOUS.
11.	If hard-copy test results are desired, set the print event criteria using the PRINT EVENT category of the MENU switch, then set the printer control block (to the left of the POWER switch) by setting the OFF/ON switch to the ON position.
12.	Using the appropriate cables, connect the FIREBERD 6000 to the equipment under test.
13.	Illuminate the RTS and DTR switches to set both signaling leads to HIGH.
14.	If performing a loopback test, establish a loop by performing the procedures which are appropriate for your DCE.
15.	Check that the SYNC LED located at the upper right corner of the FIREBERD 6000 is illuminated. **RESULT:** The FIREBERD has achieved pattern synchronization and is gathering test results.

3.10.4 RS-449/530/MIL Synchronous Test Results

Here are the synchronous test results that are available when using the RS-449/530/MIL interface.

Table 3-34
RS-449/530/MIL Test Results

CATEGORY	RESULTS		
ERROR	AVG BER BER CHAR ERR	AVG BLER BLOCKS	BIT ERRS BLK ERRS
PERFORMANCE	NO PERFORMANCE RESULTS RETURNED		
TIME	DATE EF EAS PATL SEC	ERR EAS ELAP SEC %PAT SEC	E A SEC TIME
SIGNAL	DELAY	GEN FREQ	RCV FREQ
T-CARRIER	NO T-CARRIER RESULTS RETURNED		
SIGNAL	DELAY	RCV FREQ	GEN FREQ
ALARMS	DAT LOSS	PWR LOSS	

Appendix B offers a glossary of all significant test results available with the FIREBERD 6000.

3.11 DDS LOCAL LOOP TESTING

3.11.1 Testing The Primary Channel On a 56 kb/s Circuit With Secondary Channel

Figure 3-23 shows a FIREBERD 6000 at the Customer Premise equipped with a DDS Local Loop Interface. The hard (i.e., manual) loopback at the OCU sends the transmitted data back to the FIREBERD for analysis. Once the loopback is established, the FIREBERD can test the network from the customer site (or drop side of the OCU) to the location of the loopback.

NOTE: The DDS Local Loop Interface does not establish loopbacks; all network loopbacks must be established from within the DDS network.

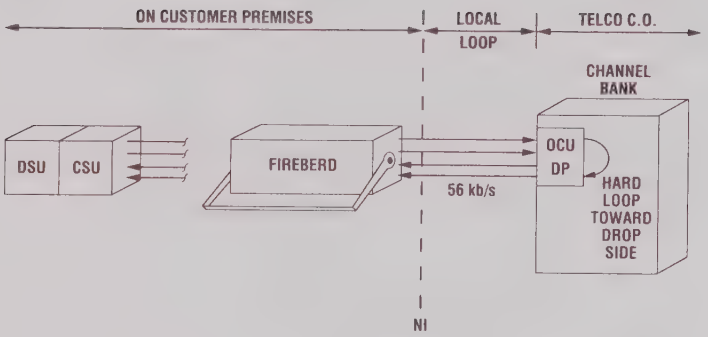

Figure 3-23
Network Loopback Test

Set-Up For Testing the Primary Channel on a 56 kb/s Circuit

Here is a table which describes how the FIREBERD 6000 can be set up to perform the test described in this section. Note that these procedures assume the presence of a secondary channel.

Table 3-35
Testing the Primary Channel on a 56 kb/s Circuit

STEP	ACTIVITY
1.	With the power to the FIREBERD 6000 turned off, insert the DDS Local Loop Interface in the rear-panel interface slot.
2.	Press the POWER switch to apply power to the FIREBERD 6000. **NOTE:** If the FIREBERD 6000 is in Self-Loop mode after power-up, disengage the SELF LOOP switch.
3.	Set the DATA switch to either the 511 or 2047 position. Note that these settings are recommended rather than required.

Table 3-35
Testing the Primary Channel on a 56 kb/s Circuit (continued)

STEP	ACTIVITY
3. (cont.)	**NOTE:** When using the DDS Local Loop Interface, the GEN CLK switch is automatically set to the INTF position. Additionally, the TIMING MODE switch is disabled; therefore no setting is required.
4.	Using the MENU switch: a. Configure the DDS Local Loop Interface using INTF SETUP. Select these softkeys: 1. RATE to access the data rate menu. 2. ▲ 56.0K to test the 56 kb/s circuit shown in the example. 3. MORE CHAN to enter the channel selection menu. 4. ON to indicate the presence of a secondary channel. 5. PRI to select primary channel analysis. 6. 511, 2047, or IDLE to select the secondary pattern. (The primary pattern is selected using the DATA switch.). 7. ▲ ▲ ▲ TX LEVEL to access the transmit level menu. 8. 0dB to add no additional loss to the transmit level. 9. ▲ MORE TX CLOCK to access the timing source menu. 10. RECOV to recover timing from the DDS network. 11. ▲ ERRINS to select the error insert menu. 12. OFF to turn off error insertion.
5.	If a timed test is desired: 1. Set the MENU switch to TEST INTERVAL. 2. Press the MORE key twice, then press the TIMED softkey. 3. Set the desired test length using the MENU keypad, then press the ENTER key. 4. Set the ANALYSIS MODE switch (located to the right of the RESULTS area) to SINGLE.
6.	If a continuous test is desired: 1. Set the MENU switch to TEST INTERVAL. 2. Set the desired measurement interval (default setting: 104), then press the ENTER key. 3. Set the ANALYSIS MODE switch (located to the right of the RESULTS area) to CONTINUOUS.
7.	If hard-copy test results are desired, set the print event criteria using the PRINT EVENT category of the MENU switch, then set the printer control block (to the left of the POWER switch) by setting the OFF/ON switch to the ON position.
8.	Using the appropriate cables, connect the FIREBERD 6000 to the equipment under test.

Table 3-35
Testing the Primary Channel on a 56 kb/s Circuit (continued)

STEP	ACTIVITY
9.	Check that the SYNC LED located at the upper right corner of the FIREBERD 6000 is illuminated. **RESULT:** The FIREBERD has achieved pattern synchronization and is gathering test results.

3.11.2 Testing 9.6 kb/s Circuit Without Secondary Channel

Figure 3-24 depicts a FIREBERD 6000 connected to the local loop. Another instrument at the serving test center sends a channel loopback in the direction of the FIREBERD. The FIREBERD recognizes and responds to the channel loopback by placing itself in a loop towards the network. The serving test center performs the bit error test; the FIREBERD can perform in-service tests such as level, current, and frame analysis.

When performing a channel loopback test, always do the following:

1. Configure the FIREBERD 6000 as described in Table 3-35.

2. Connect to the local loop.

   NOTE: If the FIREBERD 6000 is in Self-Loop mode after power-up, disengage the SELF LOOP switch.

3. Issue a channel loopback from the instrument in the serving test center.

   RESULT: The FIREBERD 6000 establishes a channel loopback; the ALM1 LED illuminates to indicate the loopback. Additionally, the message DDS LOCAL LOOP CSU LOOPBACK is flashed in the results display.

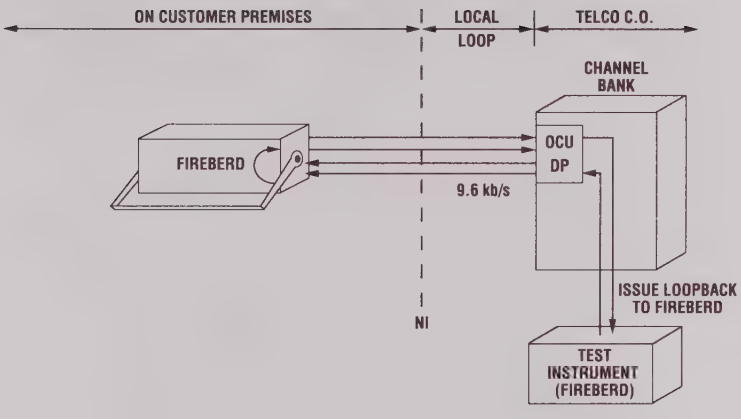

Figure 3-24
Channel Loopback Test

Set-Up For Testing the 9.6 kb/s Circuit Without a Secondary Channel

Here is a table which describes how the FIREBERD 6000 can be set up to perform the channel loopback test described in this section. Note that these procedures assume the presence of a secondary channel.

Table 3-35
Testing the 9.6 kb/s Circuit Without a Secondary Channel

STEP	ACTIVITY
1.	With the power to the FIREBERD 6000 turned off, insert the DDS Local Loop Interface in the rear-panel interface slot.
2.	Press the POWER switch to apply power to the FIREBERD 6000. **NOTE:** If the FIREBERD 6000 is in Self-Loop mode after power-up, disengage the SELF LOOP switch.
3.	Set the DATA switch to either the 511 or 2047 position. Note that these settings are recommended rather than required. **NOTE:** When using the DDS Local Loop Interface, the GEN CLK switch is automatically set to the INTF position. Additionally, the TIMING MODE switch is disabled; therefore no setting is required.

Table 3-35
Testing the 9.6 kb/s Circuit Without a Secondary Channel (continued)

STEP	ACTIVITY
4.	Using the MENU switch: a. Configure the DDS Local Loop Interface using INTF SETUP. Select these softkeys: 1. RATE to access the data rate menu. 2. 9.6K to test the 9.6 kb/s circuit shown in the example. 3. ▲ CHAN to enter the channel selection menu. 4. OFF to indicate the absence of a secondary channel. 5. ▲ TX LEVEL to access the transmit level menu. 6. 0dB to add no additional loss to the transmit level. 7. ▲ MORE ▬ TX CLOCK to access the timing source menu. 8. RECOV to recover timing from the DDS network. 9. ERRINS to select the error insert menu. 10. OFF to turn off error insertion.
5.	If a timed test is desired: 1. Set the MENU switch to TEST INTERVAL. 2. Press the MORE key twice, then press the TIMED softkey. 3. Set the desired test length using the MENU keypad, then press the ENTER key. 4. Set the ANALYSIS MODE switch (located to the right of the RESULTS area) to SINGLE.
6.	If a continuous test is desired: 1. Set the MENU switch to TEST INTERVAL. 2. Set the desired measurement interval (default setting: 104), then press the ENTER key. 3. Set the ANALYSIS MODE switch (located to the right of the RESULTS area) to CONTINUOUS.
7.	If hard-copy test results are desired, set the print event criteria using the PRINT EVENT category of the MENU switch, then set the printer control block (to the left of the POWER switch) by setting the OFF/ON switch to the ON position.
8.	Using the appropriate cables, connect the FIREBERD 6000 to the equipment under test.
9.	Check that the SYNC LED located at the upper right corner of the FIREBERD 6000 is illuminated. **RESULT:** The FIREBERD has achieved pattern synchronization and is gathering test results.

3.11.3 DDS Local Loop Interface Test Results

Here are the synchronous test results that are available when using the DDS Local Loop Interface.

Table 3-36
DDS Local Loop Interface Test Results

CATEGORY	RESULTS		
ERROR	AVG BER BER PAT SLIP	AVG BLER BLOCKS	BIT ERRS BLK ERRS
PERFORMANCE	AVL SEC G %EFS UNA SEC	%AVL SEC DEG MIN	PATL SEC %DEG MIN
TIME	ELAP SEC	TIME	DATE
T-CARRIER	BPV	AVG BVR	BPV Rate
SIGNAL	R LVL V SIMPX CUR	R LVL dB	DAT RATE
ALARMS	PAT LOSS		

Appendix B offers a glossary of all significant test results available with the FIREBERD 6000.

SECTION 4
CONFIGURING THE FIREBERD 6000 FOR PRINTER OPERATION

4.1 SECTION SUMMARY

This section describes how the FIREBERD 6000 can be configured with both the PR-40A and PR-2000 printers.

The PR-40A printer is a thermal printer that provides 40-column printouts, as well as bit-mapped histograms and jitter graphics. Although any serial ASCII printer can be used with the FIREBERD 6000, the PR-40A is highly recommended for its ease of use and its compatibility with the FIREBERD 6000.

The PR-2000 is a miniature alphanumeric printer that uses non-impact thermal printing for low cost display and instrumentation applications. The PR-2000 features 20-column printing in self-contained, rack-mountable casing, including complete control and interface electronics with AC power supply.

4.2 CONFIGURING THE FIREBERD WITH THE PR-40A PRINTER

The table immediately following shows how the FIREBERD 6000 can be configured to operate with the PR-40A printer.

Table 4-1
Configuring the FIREBERD 6000 with the PR-40A Printer

STEP:	ACTIVITY:
1.	Using the MENU switch, select the AUXILIARY function.
2.	Using the MENU keypad, type the number **38** and press the ENTER key. **RESULT:** The soft key labels BAUD, DATA, and PARITY appear in the MENU display.
3.	Press the BAUD soft key. **RESULT:** Several baud rates appear in the MENU display.

Table 4-1
Configuring the FIREBERD 6000 with the PR-40A Printer (Continued)

STEP:	ACTIVITY:
4.	MORE Press the 2400 soft key to select the 2400 baud rate.
5.	▲ Press the DATA soft key. **RESULT:** The selections associated with the DATA menu are displayed.
6.	Press the 8 soft key to select 8 data bits.
7.	▲ Press the PARITY soft key. **RESULT:** The selections associated with the PARITY menu appear in the display.
8.	Press the NONE soft key to select no parity.
9.	▲ MORE Press the TERM soft key. **RESULT:** The selections associated with the TERM menu appear in the display.
10.	Press the CR soft key to select carriage return line termination.
11.	▲ Press the PRINT soft key. **RESULT:** The selections associated with the PRINT menu appear in the display.
12.	Press the FAST soft key to select fast for standard PR-40A operation and press the ENTER key.
13.	Using the MENU keypad, type the number **37** and press the ENTER key. **RESULT:** The soft key labels COLUMN, MODE, and LAYOUT appear in the MENU display.
14.	Press the COLUMN soft key. **RESULT:** Several column widths appear in the MENU display.
15.	Press the 40 soft key to select the 40-character column width.
16.	▲ Press the MODE soft key. **RESULT:** The selections associated with the MODE menu appear in the display.

Legend
▲ Press the Up-Arrow key.
MORE Press the More key to access the next menu

Table 4-1
Configuring the FIREBERD 6000 with the PR-40A Printer (Continued)

STEP:	ACTIVITY:
17.	Press the NORMAL soft key to select standard operation.
18.	▲ Press the LAYOUT soft key. **RESULT:** The selections associated with the LAYOUT menu appear in the display.
19.	Press the FWD soft key to select standard PR-40A operation.
20.	Press the OFF/ON switch of the PRINTER control block of the FIREBERD 6000. **RESULT:** The green LED within the ON/OFF switch is illuminated.

The FIREBERD 6000 is now configured for operation with the PR-85 printer. Pressing the **CONTROLS** switch of the PRINTER control block generates a printout of the current FIREBERD switch settings.

4.3 CONFIGURING THE FIREBERD WITH THE PR-2000 PRINTER

The table immediately following shows how the FIREBERD 6000 can be configured to operate with the PR-2000 printer.

Table 4-2
Configuring the FIREBERD 6000 With The PR-2000 Printer

STEP:	ACTIVITY:
1.	Using the MENU switch, select the AUXILIARY function.
2.	Using the MENU keypad, type the number **38** and press the ENTER key. **RESULT:** The soft key labels BAUD, DATA, and PARITY appear in the MENU display.
3.	Press the BAUD soft key. **RESULT:** Several baud rates appear in the MENU display.
4.	MORE Press the 2400 soft key to select the 2400 baud rate.
5.	▲ Press the DATA soft key. **RESULT:** The selections associated with the DATA menu are displayed.
6.	Press the 7 soft key to select 7 data bits.
7.	▲ Press the PARITY soft key. **RESULT:** The selections associated with the PARITY menu appear in the display.
8.	Press the EVEN soft key to select even parity.
9.	▲ MORE Press the TERM soft key. **RESULT:** The selections associated with the TERM menu appear in the display.
10.	Press the CRLF soft key to select carriage return/ line feed line termination.
11.	▲ Press the PRINT soft key. **RESULT:** The selections associated with the PRINT menu appear in the display.

Legend

▲ Press the Up-Arrow key.

MORE Press the More key to access the next menu.

Table 4-2
Configuring the FIREBERD 6000 With The PR-2000 Printer (Continued)

STEP:	ACTIVITY:
12.	Press the SLOW soft key to select slow for standard PR-2000 operation and press the ENTER key.
13.	Using the MENU keypad, type the number **37** and press the ENTER key. **RESULT:** The soft key labels COLUMN, MODE, and LAYOUT appear in the MENU display.
14.	Press the COLUMN soft key. **RESULT:** Several column widths appear in the MENU display.
15.	Press the 20 soft key to select the 20-character column width.
16.	▲ Press the MODE soft key. **RESULT:** The selections associated with the MODE menu appear in the display.
17.	Press the NORMAL soft key to select standard PR-2000 operation.
18.	▲ Press the LAYOUT soft key. **RESULT:** The selections associated with the LAYOUT menu appear in the display.
19.	Press the BWD soft key to select standard PR-2000 operation.
20.	Press the OFF/ON switch of the PRINTER control block of the FIREBERD 6000. **RESULT:** The green LED within the ON/OFF switch is illuminated.

The FIREBERD 6000 is now configured for operation with the PR-2000 printer. Pressing the CONTROLS switch of the PRINTER control block generates a printout of the current FIREBERD switch settings.

APPENDIX A
AUXILIARY FUNCTIONS

FUNCTION	NUMBER	NAME	DESCRIPTION
Generator Clock Polarity	01	GEN CLK POL	NORMAL - Clock data phasing is per interface standard. INVERT - Clock data phasing is the inverse of the interface standard.
Receiver Clock Polarity	02	RCVR CLK POL	AUTO - Receiver clock data phasing is automatically detected, corrected, and maintained while error analysis is in progress. NORMAL - Clock data phasing is per interface standard. INVERT - Clock data phasing is the inverse of the interface standard.
Receiver Action Upon Sync Loss	03	ACT SYN LOSS	CLEAR - Clear all results counters and restarts test when synchronization is reacquired. HALT - Freeze all results for the duration of the synchronization loss. Test continues as soon as synchronization is reacquired. CONT - Continues to accumulate error analysis results while the receiver attempts to resynchronize. (Valid in SYNC and RECOVD timing modes only.)
Single Transmit	04	SINGLE TRANS	OFF - Transmit data continuously. ON - Transmit only one pattern or message each time the RESTART switch is pressed. This auxiliary function is disabled in self-loop mode.
Generator Data Inverter	06	GEN DATA INV	OFF - Transmitted data not inverted. ON - Transmitted data inverted.
Receiver Clock Select Emulation Only)	07	RCVR CLK SEL	AUTO - ST (a DCE output) is automaticallyselected if TT (a DCE input) is not present in the interface. TT - TT selected.

FUNCTION	NUMBER	NAME	DESCRIPTION
Rec. Clk. (cont.)	07	RCVR CLK SEL	ST - ST selected.
Out-of-Band Flow Control	08	OUT-BAND FLOW	OFF - Data transmission occurs regardless of signaling lead status. ON - Data transmission is conditioned upon the reception of one or more of the following signaling leads: TR, DM, RS, CS, and RR. CS is the default. This auxiliary function is disabled in self-loop mode.
In-Band Flow Control	09	IN-BAND FLOW	OFF - FIREBERD does not respond to XON and XOFF characters in the data received. (Asynchronous transmission is not affected.) ON - FIREBERD scans the incoming data for XON and XOFF characters and responds accordingly. Defaults XON to 11H and XOFF to 13H. This auxiliary function applies to asynchronous USER and FOX messages only.
Sync Loss Threshold	10	SYNC LOSS THR	Thresholds for SYNC and RECOVD timing modes are: MED - Declare sync loss when 250 bit errors are counted in less than 1000 bits. LOW - Declare sync loss when 100 bit errors are counted in less than 1000 bits. HIGH - Declare sync loss when 20,000 bit errors are counted in less than 100,000 bits. The settings for ASYNC Timing Mode are: LOW and MED - Declare sync loss when 30 character errors are counted in less than 60 received characters. HIGH - Declare sync loss when 20,000 bit errors are counted in less than 100,000 bits.

AUXILIARY FUNCTIONS (CONTINUED)

FUNCTION	NUMBER	NAME	DESCRIPTION
I/O Driver Select	11	IO DRIVER SEL	SELECT - Sets the FIREBERD for both printing and remote control in any combination of the following: Remote Control: 232, 488, None. Printing: 232, 488, Remote, None.
Block Length	30	BLK LEN	Select the block length. The allowable range is 100 - 1,000,000 bits.
Signal Delay	31	DELAY	Set up the FIREBERD for signal delay timing. The start timing and stop timing signals and edges are selected with this function. **NOTE:** The start and stop parameters that reference signaling leads are only valid for interfaces that use these signals.
Program Common Frequencies	32	COMMON FREQ	Program the most commonly used frequencies as softkey settings for the SYNTH FREQ function of the MENU switch.
Programmable Pattern	33	PATTERN	Program and edit a 3- to 24-bit data pattern, to be used when the DATA switch is set to the PRGM position. The order of data bits transmitted is left-to-right on the display. When this auxiliary function is selected, the pattern editor is in "exchange" mode. This means that any binary digits entered overwrite the digit at the cursor. Use the INSERT softkey to toggle in/out of insert mode. In insert mode, digits are inserted at the cursor without overwriting any others. Digits may be entered at the end of the pattern in either mode. The DELETE softkey deletes the digit at the cursor. The ▶ and ◀ keys on the MENU keypad are used to position the cursor. The ENTER key saves and implements all changes made to the pattern.

FUNCTION	NUMBER	NAME	DESCRIPTION
Prog. Pat. (cont.)	33	PATTERN	The UP ARROW key causes the FIREBERD to return to the unedited version of the pattern.
Site Identification	34	SITE ID	Identify a site when the FIREBERD is used in a specific network. The site ID is entered by positioning the cursor under each "digit" (using the ▶ and ◀ keys on the MENU keypad) and using the UP or DOWN softkeys to select the desired ASCII character.
Results Print	35	RESULTS PRINT	Determine the content of a results printout. STD selects the standard printout. The LONG print includes all applicable results. The CUSTOM print allows each result to be included (ON) or excluded (OFF). Note that each result is included in the printout only as long as it is applicable to the operating mode in use at the time of the printout.
Status Print Selection	36	STATUS PRINT	Enable (ON) or disable (OFF) the printing of individual status messages. When enabled, the status message is printed each time the status changes (if the printer is enabled via the OFF/ON switch in the PRINTER block); when disabled, the status message is not printed.
Printout Format	37	PRNT FRMT	Specify the printout format, as follows: COLUMN - choose 20-, 40-, or 80-column printouts. TERM - choose carriage return-line feed (CRLF), carriage return (CR), line feed (LF), or no (NONE) line termination. MODE - choose SLOW (maximum 20 characters per second) or FAST print speed (full baud rate).

FUNCTION	NUMBER	NAME	DESCRIPTION
RS-232 Driver Set-up	38	232	Used to configure the RS-232 printer/ remote controller interface. The display for this function appears as: 232: bbbb,d,pppp where bbbb is the baud rate: 110, 300, 600, 1200, 2400, 4800, 9600. d is the number of data bits: 7,8. pppp is the parity: ODD, EVEN, NONE.
IEEE-488 Address	39	488	View the current address of the IEEE-488 Printer/Remote control interface, as follows: 488: ADDR: 20 where 20 is the address of the controller (range: 0 - 31). Note that the controller is only addressable when Auxiliary Function 11 (I/O Driver Select) is used to specify IEEE-488 remote control; when IEEE-488 is specified for a printer, the message TALK appears in the display in lieu of an address.
Software Version	40	SOFTWARE VERSION	Display the current software version and the date the software was revised. SW Version: G (C) TTC, 12/17/90
User Message Selection	41	USER MESSAGE	Select from a series of patterns which are supplemental to those available through the DATA switch: 1:7, 3-IN-24, T1-1/T1-6, T1-mW, and DDS-1/6. A FIREBERD equipped with Long User Pattern (LUP) capability is required for all timing modes except asynchronous. Long User Patterns (LUPs) Auxiliary Function 41 can also be used to enter or edit up to three patterns of up to 2048 characters each. Any of these patterns may be used when the DATA switch is set to the USER

FUNCTION	NUMBER	NAME	DESCRIPTION
User Message Sel. (cont.)	41	USER MESSAGE	position. Characters are entered in hexidecimal format (0-9 and A-F) from the MENU keypad; the ▶ and ◀ keys are used to position the cursor. In the hexidecimal format, 2 digits are required to define a character; thus, the cursor is 2 digits wide. The INSERT softkey is used to insert characters without overwriting the existing ones. When not inserting, the characters entered overwrite the characters at the cursor. Characters may be added at the end of the user message in either case. The DELETE softkey deletes the character at the cursor. The display for this function is: xxxxxxxxxxxxx*yyyy where xx is the user message and yyyy is the numerical position of the byte underlined by the cursor. After creating a message or editing an existing one, press the ENTER key to save and implement it.
Recall Pre-Sync Loss	42	PRE SYNC LOSS	Transfer the test results recorded from 2 to 4 seconds before a synchronization or power loss to the results display buffer. In such instances, an automatic display hold is performed, *and test results are automatically sent to a printer, if one is enabled.* If no sync or power loss has occurred since the test started, the message **Pre sync/power loss results not available** is displayed.
Clear Non-Volatile Settings	43	CLEAR NOVRAM	Clear the FIREBERD 6000 of its current settings for stored programs, patterns, and user RAM messages. When selected, all settings are returned to their factory-set values. The user must verify this operation before it is actually performed.

FUNCTION	NUMBER	NAME	DESCRIPTION
Histogram Setup	44	HISTO-GRAM	Select the results to be graphed and the scale to be used for histogram plots.
User Message Sync Threshold	45	USR SYN THR	Select the number of unerrored bytes within the user message that must be received before pattern synchronization is established. PATL specifies that the entire pattern length must be received unerrored to declare pattern synchronization. The BYTE selection is used to specify a variable number of unerrored bytes (values between 10-2048 bytes) that must be received to declare pattern synchronization. This function only affects synchronous user messages.
Async Data Timeout	46	ASYNC TIMEOUT	Select the action taken when no data is received in asynchronous timing mode. ON forces a synchronization loss after 10 seconds have passed without receiving data; OFF does not force a sync loss under identical conditions.
Time/Date Set	60	TIME/ DATE	Set the FIREBERD's time and date calendar. The display shows: HH:MM:00 DD/MM/YY When changing either the data or time, position the cursor under the field to be changed and enter the correct number from the keypad. All or part of the time/date may be modified. The hours are in 24-hour format and range from 00 to 24. Setting the minutes automati cally sets the seconds to 00. The ENTER key implements the setting.
Clear Status	99	CLEAR FUNC IN USE	Reset the status-select auxiliary functions to their factory-set (i.e., default) states. When selected, the AUX FUNC in use panel label is turned off.

APPENDIX B
ANALYSIS RESULTS AND MESSAGES

B.1 ANALYSIS RESULTS

ERROR Category

Average Bit Error Rate (AVG BER) - The ratio of the number of bit errors counted to the number of data bits examined since the beginning of the test.

Bit Errors (BIT ERRS) - The number of errored data bits counted since the beginning of the test.

Bit Error Rate (BER) - The ratio of the number of bit errors counted over the last test interval to the number of data bits examined in the last test interval.

Blocks (BLOCKS) - The number of complete blocks received since the beginning of the test. The length of a block is set through Auxiliary Function 30.

Block Errors (BLK ERRS) - The number of complete blocks received since the beginning of the test that contain one or more bit errors.

Average Block Error Rate (AVG BLER) - The ratio of the number of block errors counted to the number of blocks examined since the beginning of the test.

Character Errors (CHAR ERR) - In asynchronous timing, the number of characters received since the beginning of the test that contain one or more data errors.

Pattern Slips (PAT SLIP) - The number of occurrences since the beginning of the test where data bits have been added to or deleted from the received pattern.

PERFORMANCE Category

G.821 Errored Seconds (GERR SEC) - The number of available seconds in which at least one bit error occurred.

G.821 Error-Free Seconds (G EFS) - The number of available seconds in which no bit errors occurred.

G.821 % Error-Free Seconds (G %EFS) - The ratio of the number of available seconds in which no errors were detected to the total number of available seconds, expressed as a percentage.

Degraded Minutes (DEG MIN) - The number of blocks of 60 non-severely errored, available seconds in which the average BER was worse than 10^{-6}. Note that CCITT Recommendation G.821 eases this requirement at 64 kHz; when the average BER over 60 seconds is 64 kHz, and four bit errors are counted, the minute is not considered to be degraded.

% Degraded Minutes (%DEG MIN) - The ratio of the number of degraded minutes to the number of minutes derived from available, non-severely errored seconds, expressed as a percentage.

Severely Errored Seconds (SES) - The number of available seconds during which the BER is higher than 10^{-3}.

% Severely Errored Seconds (%SES) - The ratio of the number of severely errored seconds to the number of available seconds, expressed as a percentage.

G.821 Violation-Free Seconds (G VFS) - The number of available seconds in which BPVs were not detected.

G.821 % Violation-Free Seconds (G %VFS) - The ratio of the number of available seconds in which BPVs were not detected to the total number of available seconds, expressed as a percentage.

Unavailable Seconds (UNA SEC) - The number of seconds judged unavailable by CCITT criteria.

Available Seconds (AVL SEC) - The number of seconds judged available by CCITT criteria.

PERFORMANCE Category (continued)

% Available Seconds (%AVL SEC) - The ratio of the number of available seconds to the number of test seconds since initial pattern synchronization, expressed as a percentage.

Severely Violated Seconds (SVS) - The number of available seconds during which the BPV rate was higher than 10^{-3}.

% Severely Violated Seconds (%SVS) - The ratio of the number of severely violated seconds to the number of available seconds, expressed as a percentage.

Bit Errors Minus Severely Errored Seconds (ERR-SES) - The total number of bit errors, excluding the errors that occurred during severely errored seconds.

Bit Error Rate Minus Severely Errored Seconds (BER-SES) - The bit error rate, excluding the errors that occurred during severely errored seconds.

TIME Category

Pattern Sync Loss Seconds (PATL SEC) - The number of seconds during which the receiver was not in continuous pattern synchronization.

% Pattern Sync Seconds (%PAT SEC) - The ratio of the number of seconds in which pattern synchronization was achieved with no synchronization losses to the total number of seconds since initial pattern synchronization, expressed as a percentage.

Signal Loss Seconds (SIGL SEC) - The number of seconds during which the signal was not present for any part of the second.

% Active Seconds (%ACT SEC) - The ratio of the number of seconds during which a signal was present (active) for the entire second to the total number of seconds since initial signal presence, expressed as a percentage.

Time of Day (TIME) - The time of day in hours, minutes, and seconds. Hours are displayed in a 24-hour format. The current time is set using Auxiliary Function 60.

TIME Category (continued)

Calendar Date (DATE) - The calendar date in day, month, and year. The current date is set using Auxiliary Function 60.

Elapsed Seconds (ELAP SEC) - The number of seconds, based on the time-of-day clock, since the last major switch change or test restart.

Error Analysis Seconds (EA SEC) - The amount of time during which error analysis has been performed, expressed in seconds. The time that error analysis is performed depends on receiver pattern synchronization and the setting of Auxiliary Function 03 (Receiver Action Upon Sync Loss).

Errored Error Analysis Seconds (ERR EAS) - The number of error analysis seconds during which one or more bit errors were detected. Errored error analysis seconds are asynchronous.

Error-Free Error Analysis Seconds (EF EAS) - The number of error analysis seconds during which no bit errors were detected.

SIGNAL Category

Delay (DELAY) - The most recently measured time interval between the start and finish of specific events. The start and stop events are selected using Auxiliary Function 31.

Maximum Jitter (MAX JTR) - The largest value of 1-second jitter measured since the beginning of the test, expressed in Unit Intervals (UIs) peak-to-peak.

1-Second Jitter (1SEC JTR) - The maximum amount of timing jitter measured over the last 1-second test interval, expressed in UIs peak-to-peak.

Jitter Hits (JTR HITS) - A count of the number of times that jitter has exceeded the selected hits threshold since the beginning of the test.

Positive Wander (+WNDR) - The maximum positive peak wander deviation since the beginning of the test, expressed in UIs.

SIGNAL Category (continued)

Negative Wander (-WNDR) - The maximum negative peak wander deviation since the beginning of the test, expressed in UIs.

Peak-To-Peak Wander (PP WNDR) - The total deviation of positive-to-negative peak wander since the beginning of the test, expressed in UIs.

15-Minute Wander (15m WNDR) - The maximum peak-to-peak wander deviation over the last 15 minutes of the test. This result is unavailable during the first 15 minutes of the test and is updated once per minute thereafter.

24-Hour Wander (24h WNDR) - The maximum peak-to-peak wander deviation over the last 24 hours of the test. This result is unavailable during the first 24 hours of the test and is updated once per hour thereafter.

TIE Wander (TIE WNDR) - Time Interval Error (TIE); the variation in time delay of a given signal with respect to the T1 reference signal or external clock source over the test interval.

Receiver Frequency (RCV FREQ) - The current measurement of the receiver clock frequency.

Generator Frequency (GEN FREQ) - The current measurement of the generator clock frequency.

% of Jitter Mask (%MASK) - Each time the jitter spectrum analyzer takes a reading, the ratio of the measured jitter amplitude to the reference jitter mask's value is calculated. If the spectrum analyzer is sweeping, then the maximum value of that ratio since the beginning of the test is displayed as a percentage; a value of less than 100% indicates that no spectrum analyzer reading exceeded the reference mask during the test. If the spectrum analyzer is not sweeping, then the ratio of the last spectrum analyzer reading to the reference mask at that frequency is displayed as a percentage.

Spectrum Analyzer Frequency (S/A nnn) - The current spectrum analyzer frequency in Hertz or, if noted, kHz. Additionally, the measured jitter amplitude at the current frequency is displayed in unit intervals peak-to-peak. If the spectrum analyzer is sweeping,

the amplitude is the largest measured at this frequency; if the spectrum analyzer is not sweeping, the amplitude is the last measured at this frequency.

Received Byte (RCV BYTE) - The received data bytes displayed in binary form.

Received Code (RCV CODE) - When a T1 interface is selected, this result reflects the type of line coding received (e.g., B8ZS, AMI, etc.). When a DDS interface is selected, this result reflects the received bytes which are interpreted as special network codes; the name of the network code is displayed in abbreviated form.

ISDN Power Feeding Status (PWR STAT) - In ISDN testing, a check of the NT's power feeding status, displayed as a result.

Receiver Signal Level in Volts (R LVL V) - In ISDN and DDS Local Loop testing, a measurement of the receiver signal level in volts. The range and resolution of this measurement are interface-dependent.

Receiver Signal Level Measurement in Decibels (R LVL dB) - In ISDN and DDS Local Loop testing, a measurement of the receiver signal level in decibels. The range and resolution of this measurement are interface-dependent.

Transmitter Info State (TX INFO) - In ISDN testing, the specific sequence of the line signals used to bring the NT and TE into synchronization.

Receiver Info State (RCV INFO) - In ISDN testing, the specific sequence of line signals used to bring the TE and NT into synchronization.

Terminal Equipment Identifer (TEI) - When testing an AT&T ISDN switch, the actual TEI assigned.

Positive Receive Level in Volts (+LVL V) - The level of the received signal in volts, measured on the positive T1 pulses. The range and resolution of this measurement are interface-dependent.

SIGNAL Category (continued)

Positive Receive Level in Decibels (+LVL dB) - The level of the received signal in decibels, relative to the positive level measurement. The range and resolution of this measurement are interface-dependent.

Negative Receive Level in Decibels (-LVL dB) - The level of the received signal in dB, relative to the negative level measurement. The range and resolution of this measurement are interface-dependent.

Negative Receive Level in Volts (-LVL V) - The level of the received signal in volts, measured on negative pulses. The range and resolution of this measurement are interface-dependent.

Receive Level in Decibels - (LVL dBm) - The power level of an unframed all-ones signal (available only when AIS is detected).

Peak-to-Peak Receive Level in Volts (PP LVL V) - The level of the received signal in peak-to-peak volts. The range and resolution of this measurement are interface-dependent.

Data Rate (DAT RATE) - In local loop testing, the received data rate of the primary or secondary channel being analyzed, expressed in b/s.

Simplex Current in mA (SMPX CUR)
The magnitude of the simplex current flowing between the transmit output tip and ring and the receive input tip and ring (interface-dependent).

T-CARRIER Category

This category contains interface-specific analysis results.

Bipolar Violations (BPVs) - In T1 testing, the number of BPVs detected in the received signal.

Average BPV Rate (AVG BPVR) - In T1 testing, the ratio of the number of BPVs detected to the number of data bits examined since the beginning of the test.

BPV Rate (BPV Rate) - In T1 testing, the ratio of the number of BPVs detected over the last test interval to the number of data bits examined.

Code Errors (CODE ERR) - In 2048 kb/s testing, the number of code errors detected in the received signal.

Average Code Error Rate (AVG CER) - In 2048 kb/s testing, the ratio of the number of code errors detected to the number of data bits examined since the beginning of the test.

Code Error Rate (CER) - In 2048 kb/s testing, the ratio of the number of code errors detected over the last test interval to the number of data bits examined.

Violation-Free Error Analysis Seconds (V F EAS) - The number of error analysis seconds during which no BPVs or code errors were detected.

% Violation-Free Error Analysis Seconds (% V F EAS)- The number of violation-free error analysis seconds to the number of error analysis seconds since the beginning of the test.

Frame Errors (FRA ERR) - The number of errored framing bits detected since the beginning of the test.

Average Frame Error Rate (AVG FER) - The ratio of the number of frame errors detected to the number of framing bits examined since the beginning of the test.

Frame Error Rate (F E Rate) - The ratio of the number of frame errors counted over the last test interval to the number of framing bits examined in the last test interval.

Frame Losses (FRA LOSS) - The number of times that frame synchronization has been lost since the beginning of the test.

CRC Errors (CRC ERR) - The number of CRC errors detected since the beginning of the test.

Average CRC Errors (AVG CRC) - The ratio of the number of CRC errors detected to the number of CRCs examined since the beginning of the test.

T-CARRIER Category (continued)

CRC Error Rate (CRC E Rt) - The ratio of the number of CRC errors detected over the last test interval to the number of CRCs examined.

Frame Alignment Signal (FAS) Errors (FAS ERR) - In 2048 kb/s testing, the number of FAS errors detected since the beginning of the test.

Average FAS Error Rate (AVG FAS) - In 2048 kb/s testing, the ratio of the number of FAS errors detected to the number of frame words examined since the beginning of the test.

FAS Error Rate (FAS E Rate) - In 2048 kb/s testing, the ratio of the number of FAS errors detected over the last test interval to the number of frame words examined in the last test interval.

One-Second CRC Errors (1 SEC CRC) - The number of CRC errors counted in the last test second.

Layer 2 Frame Errors (L2 F ERR) - In ISDN testing, the number of layer 2 frame errors. Caused by receiving an LAPD frame (packet) that does not have an integral number of octets.

Frame Check Sequence Errors (FCS ERR) - In ISDN testing, the number of frames with an incorrect CRC set.

Layer 2 Frame Abort (L2 ABORT) - In ISDN testing, the number of layer 2 frame aborts. Frame aborts terminate the LAPD frame in progress without processing.

Number of Layer 2 Frames (L2 FRMS) - In ISDN testing, the total number of Layer 2 frames received.

Rejection Frames (REJ FRM) - In ISDN testing, the number of rejection frames sent by the peer entity in response to a frame received with an FCS (CRC) error.

Frame Rejection Frames (FRMR) - In ISDN testing, the number of frame rejection frames sent by the peer entity in response to an unrecognized entity (e.g., bad flag, unknown command).

Maximum Zeros (MAX ZERO) - The maximum number of consecutive zeros received since the last test restart.

T-CARRIER Category (continued)

Bit Slips (BIT SLIP) - In T1 testing, the number of bit slips in a frame, ranging from -32767 to +32767.

Received Bit Oriented Message (RCV BOM) - In T1 testing, one of five ASCII messages on the ESF data link, as follows:

- YEL ALM - yellow alarm
- LLB ACT - line loopback activate
- LLB DEA - line loopback deactivate
- PLB ACT - payload loopback activate
- PLB DEA - payload loopback deactivate

Received BOMs not listed are displayed in binary form.

Received ABCD (RX ABCD) - In T1 testing, the ABCD signal of a DS0 channel selected via the interface set-up menu.

ALARM Category

Pattern Synchronization Loss (PAT LOSS) - The number of times a pattern synchronization loss is detected.

Data Loss (DAT LOSS) - The number of times a receiver synchronization loss results from a loss of receiver data.

Clock Loss (CLK LOSS) - The number of times a receiver sync loss results from a loss of receiver clock.

Receiver Clock-Data Phase Changes (C-D CHA) - The number of times that the clock-data phase has changed since the beginning of the test.

Power Loss (PWR LOSS) - The number of power losses since the last manual test restart or major switch change.

Signal Loss (SIG LOSS) - The number of times the receiver signal is lost.

Yellow Alarm Seconds (YEL SEC) - The number of seconds since the beginning of the test in which a yellow alarm was active.

ALARM Category (continued)

Excess Zero Seconds (XS0 SEC) - The number of seconds since the beginning of the test in which excess zeros have occurred.

Alarm Indication Signal Seconds (AIS SEC) - The number of seconds since the beginning of the test in which the AIS alarm was active.

Ones Density Seconds (1s DEN S) - The number of seconds since the beginning of the test in which ones density violations have occurred.

Violated Frame Seconds (V FR SEC) - A count of the number of seconds in which there was at least one violated frame.

Remote Alarm Seconds (REM SEC) - A count of the number of seconds in which at least one remote alarm has occurred.

B.2 MESSAGES

Async frequency contention - the selected frequency is not compatible with asynchronous operation. This message is generated when asynchronous timing is selected and the frequency synthesizer is set to a value greater than 20 kHz. While this message is flashing, a default frequency of 20 kHz is used.

Async pattern contention - the selected test pattern is not compatible with asynchronous operation. While this message is flashing, a default pattern of 1:1 is used.

Frame loss - a frame synchronization loss has occurred.

Different intf - the configuration being recalled includes an external interface which does not match the one that is currently installed.

Gen hold <sig> off - shows which signal is causing a hold condition when the generator is inhibited (<sig> is replaced by the name of the signal). Transmission can be stopped by CTS, RTS, DTR, DSR, or RLSD via Auxiliary Function 08.

Async framing err - framing errors are detected in the incoming asynchronous data.

Data overrun - the USART received too many characters before the FIREBERD received the data from the USART. Occurs during asynchronous testing.

No interface - the FIREBERD is powered up with no modular interface installed.

Dialing - in ISDN testing, displayed when the DIAL softkey is pressed.

Ringing - in ISDN testing, indicates the presence of an incoming call.

Ring Back - in ISDN testing, indicates the call is ringing on the network end.

Call Connected - in ISDN testing, indicates that the call is connected on the network.

Connect Fail: XXX - call failed, where XXX is a value from 1 to 255. This message alternates with the cause of the failure.

Call Cleared - in ISDN testing, indicates the normal termination of a call.

Interface ERR: XX - ISDN interface error detected.

Data Call Ignored - in ISDN testing, indicates that the incoming data call ignored (as specified in the ANSWER menu).

This TE Not Active - in ISDN testing, indicates that the user presses the DIAL softkey while in DEACT state.

B Channel in Use by this TE - in ISDN testing, indicates that the user pressed DIAL while a call on the selected B-channel was in progress.

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